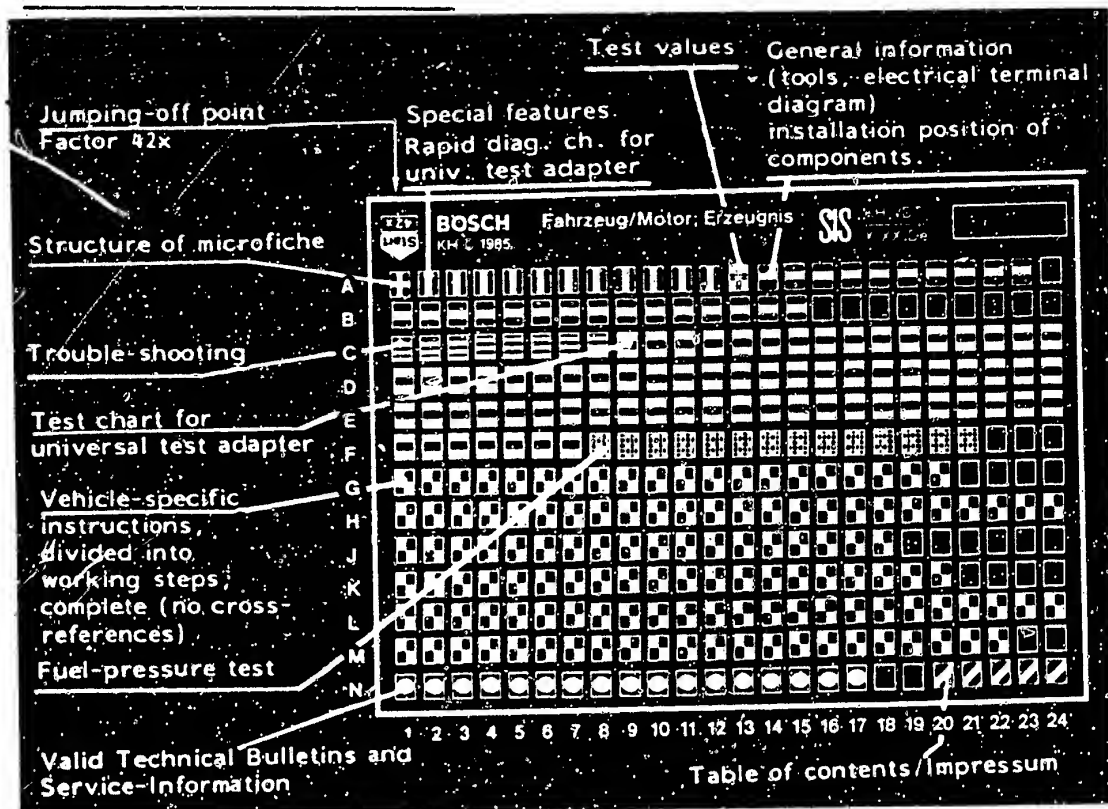


## Structure of microfiche

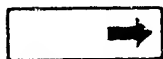


1. Read from left to right
2. Title of microfiche (appears on each coordinate)

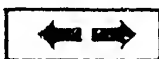
<b>E16</b>	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



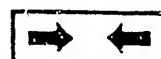
Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

**C6**

<b>A1</b>	Trouble-shooting program	
-----------	--------------------------	--

PORSCHE 928 S US version (12.84 →)

with 8-cyl./5.0 l engine (32 valves)  
and LH 2.2-Jetronic

### SPECIAL FEATURES

- Digital LH-control unit (additional new functions)
- Hot-wire air-mass sensor instead of air-flow sensor.
- Cold-start control
- Adaptive overrun cutoff
- Double temperature sensor II (engine) for Jetronic and electronic ignition system.
- Main relay and pump relay are installed instead of a control relay (in central-electrics box).
- Two pressure dampers
- Secondary-air injection.

The control unit and the peripherals are checked during the test with the universal test adapter (special LH2 adapter lead).

### RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced L-Jetronic expert to quickly check the electrical part of the system with the universal test adapter.

The rapid diagnosis chart contains the following information

- Sequence of test steps
- Settings of V and  $\Omega$  program switches
- Notes on how to operate the universal test adapter or other components
- Test specifications for motortester and multimeter
- References to coordinates of the respective detailed testing and trouble-shooting program.

If detailed information and instructions are required, always proceed in accordance with the trouble-shooting charts starting on Coordinates C1/C2.



# Rapid diagnosis chart for universal test adapter

Test step	Switch position		Measurement	Remarks	Test specifications (Reading)	Trouble-shooting
	V	$\Omega$				
1	↓	5	Resistance of temperature sensor NTC II (engine temperature). On control-unit plug between term. 2 and term. 11.	---	(+15°C...+30°C): 1.45...3.3 k $\Omega$ (+80°C): 280...360 $\Omega$	C 12
2	↓	6	Resistance of output stage ground on control-unit plug between term. 25 and term. 11.	---	0 ... 10 $\Omega$	C 14
3	↓	7	Resistance of ground terminal of sensors. On control-unit plug between term. 5 and term. 11.	---	0 ... 10 $\Omega$	C 16
4	↓	8	Resistance of all 8 parallel-connected solenoid-operated injection valves and, in series with them, the electric fuel pump. On control-unit plug between term. 13 and 11.	---	(+15°C...+30°C): 6.0...8.2 $\Omega$ (+80°C): 6.2...8.5 $\Omega$	C 18
5	↓	9	Resistance of idle contact in throttle-valve switch. On control-unit plug between term. 3 and term. 11.	Accelerator in rest position	0 ... 10 $\Omega$	C 21
6	↓	10	Resistance of full-load contact in throttle-valve switch. On control-unit plug between term. 12 and term. 11.	Accelerator in full-load position.	0 ... 10 $\Omega$	C 23
7	↓	11	Winding 1 of idle actuator and electric fuel pump in series. On control-unit plug between term. 10 and term. 11	On idle actuator check at following terminals: Term. 1 and 2	(+15°C...+30°C): 20 ... 32 $\Omega$ (+80°C): 24.5...37 $\Omega$	D 1
8	↓	12	Winding 2 of idle actuator and electric fuel pump in series. On control-unit plug between term. 23 and term. 11	Check idle actuator at following terminals: Term. 3 and 2	+15°C...+30°C): 18.0...29.5 $\Omega$ +80°C: 22.0...34.0 $\Omega$	D 3

**A3**

Rapid diagnosis chart  
Porsche 928 S USA

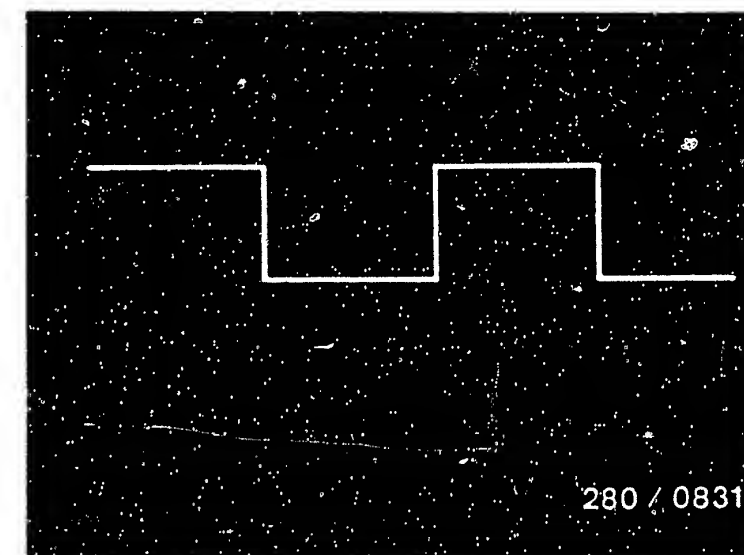

**A4**

Rapid diagnosis chart  
Porsche 928 S USA



# Rapid diagnosis chart for universal test adapter

Test step	Switch position		But-ton	Measurement	Remarks	Test specifi-cations (Reading)	Trouble-shooting
	V	$\Omega$					
9	↓	14	-	Data encoding on control-unit plug between term. 19 and term. 11	Jumper not connected on control-unit plug	$\infty \Omega$	D 5
10	↓	21	-	Potentiometer for idle-mixture adjustment. Resistance of potentiometer. On control-unit plug between term. 14 and term. 6	dependent on CO adjustment	<u>150...600 <math>\Omega</math></u>	D 7
11	5	21	-	Voltage pulses from ignition control unit ( $t_n$ ). On control-unit plug between term. 1 and term. 11	Ignition "ON". Measure $t_n$ signal with oscilloscope. Shift gear to neutral and start.	<u>see top diagram</u>	D 9
12	6	21	4	Voltage from main relay term. 87. On control-unit plug between term. 9 and term. 11	Ignition "ON".	<u>8...15 V</u>	D 13
13	7	21	-	Voltage from power-supply relay term. 87. On control-unit plug between term. 18 + 11	Ignition "ON".	<u>8...15 V</u>	D 15
14	8	21	-	Voltage at main relay (winding) term. 85. On control-unit plug between term. 21 and term. 11.	Ignition "ON".	<u>8...15 V</u>	D 15



$t_n$  signal

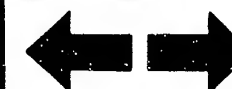
**A5**

Rapid diagnosis chart  
Porsche 928 S USA



**A6**

Rapid diagnosis chart  
Porsche 928 S USA



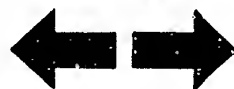


# Rapid diagnosis chart for universal test adapter

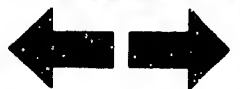
Test step	Switch position		But-ton	Measurement	Remarks	Test specifications (Reading)	Trouble shoot-ing
	V	Ω					
15	9	21	-	Voltage at pump relay (winding) term. 85. On control-unit plug between term. 17 and term. 11	Ignition "ON".	<u>8 ... 15 V</u>	D 19
				Connect adapter lead to peripherals and control unit (ignition OFF) Then warm engine up (normal operating temperature)			
16	10	21	-	Voltage at air-conditioner switch (if applicable) On control-unit plug between term. 16 and term. 11	Switch on air conditioner - to de-frost (after approx. 2 sec. the mag-netic clutch engages)	<u>8 ... 15 V</u>	D 21
17	3	21	-	Output voltage of hot-wire air-mass sensor between term. 5 and term. 3 On control-unit plug between between term. 7 and term. 6	When engine speed changes output voltage must also change	<u>2 ... 5 V</u>	D 23
				Lambda closed-loop control functional test			
18	11	21	-	Lambda closed-loop control - open-loop value. On control-unit plug between term. 22 and term. 11	Ω switch positions 22, 23 and 24 not allowed	<u>10 ... 13 V</u>	E 3
19	11	22	-	Lambda closed-loop control - rich value. On control-unit plug between term. 22 and term. 11	---	<u>10 ... 13 V</u>	E 5
20	11	23	-	Lambda closed-loop control - lean value. On control-unit plug between term. 22 and term. 11	Reading is obtained after approx. 10 sec.	<u>less than 0.5 V</u>	E 7
21	11	24	-	Lambda closed-loop control - closed-loop value. On control-unit plug between term. 22 and term. 11	---	<u>0 ... 13 V</u> (alternating between low and high values)	E 9
22	11	24	-	Basic idle setting On the test socket connect a jumper between B and C. Remove jumper after test.	Read off engine speed on motortester and adjust if necessary (electrical devices off)	<u>660 ... 700 min<sup>-1</sup></u>	E 15

**A7**

Rapid diagnosis chart  
Porsche 928 S USA

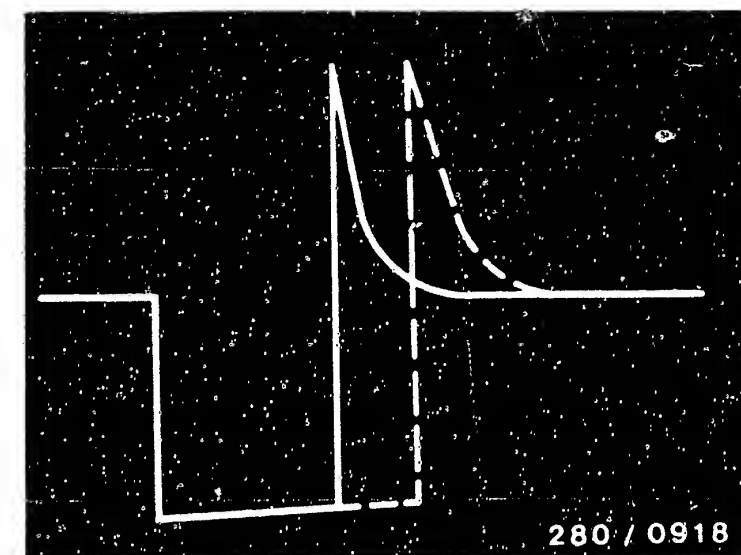

**A8**

Rapid diagnosis chart  
Porsche 928 S USA



# Rapid diagnosis chart for universal test adapter

Test step	Switch position		But-ton	Measurement	Remarks	Test speci-fications (Reading)	Trouble-shooting
	V	Ω					
23	11	24	-	Record on/off ratio at idle actuator.	Measurement with dwell-angle tester at sockets 1 and 2 (1) Idle speed (2) Jumper between B and C on test socket (3) Open throttle, engine speed 1500 min <sup>-1</sup> (4) Switch on air conditioner (if applicable) (5) Run engine at idle, air conditioner to "defrost"	(1) 31.5...34% (2) 28...30% (3) 42...48% (4) must rise by approx. 5% (5) 34...40%	E 17
24	12	24	-	Functional test of control unit (engine at normal op.temp.) Check injection signal t <sub>i</sub> from control unit with oscilloscope. On control-unit plug between term. 13 and term. 11	Let engine run at normal operating temperature.	see top diagram	E 19
25	12	24	1	As 24, but after pressing button (NTC I-cold) duration of injection becomes slightly longer and/or rise in engine speed	Let engine run at normal operating temperature.	Engine speed rises above 2000 min <sup>-1</sup> and or see top diagram	E 21
26	12	24	2	As 24, but after pressing button (NTC II-warm) duration of inj. must remain constant.	Let engine run at normal operating temperature.	See top diagram	E 23



**A9**

Rapid diagnosis chart  
Porsche 928 S USA



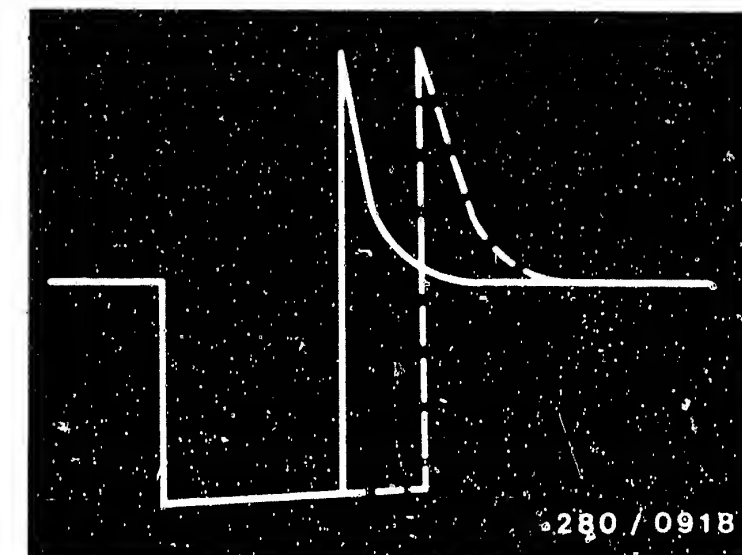
**A10**

Rapid diagnosis chart  
Porsche 928 S USA



# Rapid diagnosis chart for universal test adapter

Test step	Switch position		Button	Measurement	Remarks	Test specifications (Reading)	Troubleshooting
	V	$\Omega$					
27	12	24	5	Functional test of control unit- overrun cutoff. On control-unit plug between term. 13 and term. 11	Let engine run at normal operating temperature. Hold engine speed constant at 2000 min <sup>-1</sup> . Press button 5. Injection signals stop and start again at approx. 1300 min <sup>-1</sup> .	Briefly no injection signals	F 1
28	12	24	6	Functional test of control unit - full-load enrichment. On control-unit plug between term. 13 and term 11	Let engine idle at normal operating temperature. Injection signal must become wider and/or engine speed must increase when button 6 is pressed.	see top diagram	F 3
29	13	24	-	Hot-wire air-mass sensor. Voltage measurement of self-cleaning function. On control-unit plug between term. 8 and term. 11	Before this test, the engine must have run at above 2000 min <sup>-1</sup> and the engine temperature must have been greater than +60°C. Then switch ignition "OFF" - voltage reading after approx. 4 sec.	2 ... 5 V (length of reading approx. 1 sec.).	F 5



Wider injection signal after pressing button 6.

**A11**

Rapid diagnosis chart  
Porsche 928 S USA



**A12**

Rapid diagnosis chart  
Porsche 928 S USA



## TEST SPECIFICATIONS

**F18**

### Pressure regulator

- Fuel pressure

2.3 ... 2.7 bar**F7**

### Electric fuel pump

- Delivery (measured in return): min. 1350 cm<sup>3</sup>/30s
- Terminal voltage (under load): min. 12 V

**C12**

### Temperature sensor II (Engine) (blue plug)

- Electrical internal resistance at ambient temperature (+15°C...+30°C):

1.45 ... 3.3 k $\Omega$ 

with engine at op.temp.(approx.+80°C): 280 ... 360  $\Omega$

**C18**

### Solenoid-operated injection valve (at +15°C...+30°C):

- Electrical internal resistance

14.5 ... 17.0  $\Omega$ **G13**

### Hot-wire air-mass sensor

Electrical internal resistance between term. 6 and term. 3:

0 ... 1100  $\Omega$ 

between term. 5 and term. 3:

3.5 ... 4.1  $\Omega$ **E15**

Idle speed:

660...700 min<sup>-1</sup>

Exhaust-gas setting, CO concentration

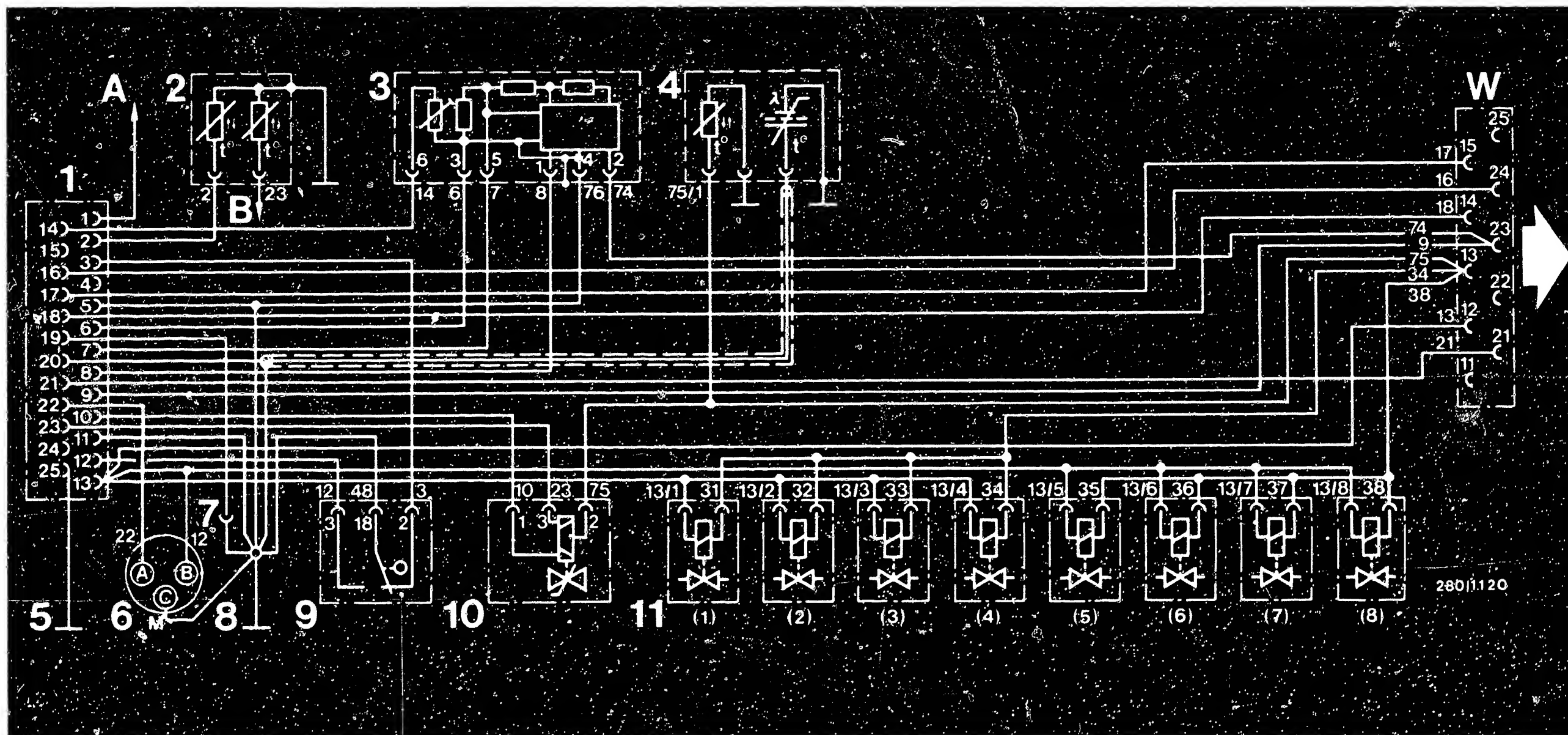
(with engine at op.temp.): 0.4...0.8 vol%CO  
measured before catalytic converter

**A13**

Test specifications

Porsche 928 S USA





ELECTRICAL TERMINAL DIAGRAM

- 1 = Control unit
- 2 = Double temperature sensor
  - 1 Temperature sensor - Jetronic
  - 1 Temperature sensor - Ignition (B)
- 3 = Hot-wire air-mass sensor
- 4 = Heated lambda sensor

- 5 = Output stage ground terminal
- 6 = Diagnosis socket
  - A = Lambda integrator output
  - B = Test socket for idle-speed control (test pin)
  - C = Ground
- 7 = Data encoding plug connector

- 8 = Electronics ground terminal
- 9 = Throttle-valve switch
- 10 = Idle actuator
- 11 = Injection valves
  - A = to EZ control unit term. 16
  - B = to EZ control unit term. 23
- W = 10-pin plug, central-electrics box

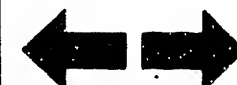
**A14**

Electrical terminal diagram  
Porsche 928 S USA

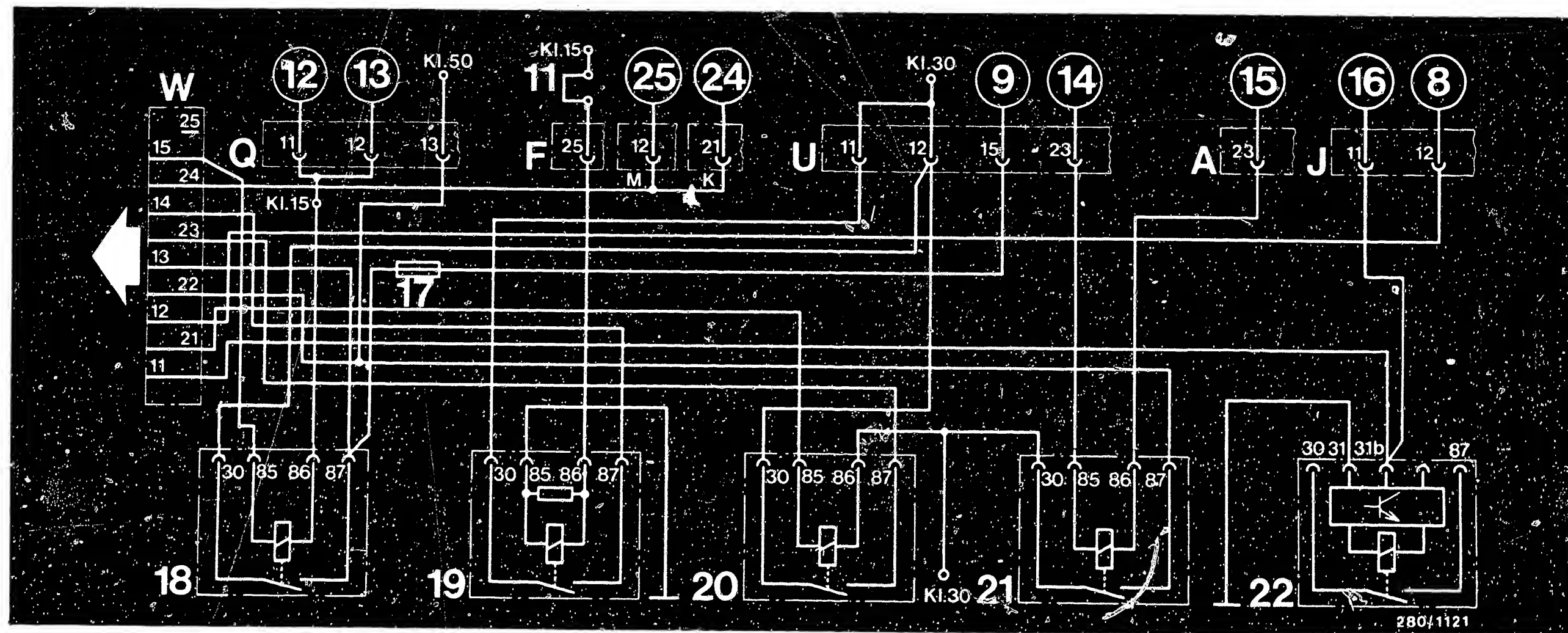


**A15**

Electrical terminal diagram  
Porsche 928 S USA







Terminal diagram of central-electrics box (connecting leads for LH version)

W = 10-pin plug of central-electrics box

11 = to EZ control unit term. 16  
 12 = to LH control unit term. 13  
 13 = Positive power supply to  
 injection valves  
 14 = to LH control unit term. 18  
 15 = to LH control unit term. 17  
 21 = to LH control unit term. 21  
 22 = not applicable to LH control unit  
 23 = to LH control unit term. 9  
 and hot-wire air mass sensor term. 2  
 24 = to LH control unit term. 16

8 = Fuel-consumption measuring instrument  
 9 = Electric fuel pump  
 11 = Jumper (not on vehicles with alarm systems)  
 12 = Ignition coil 1 term. 15  
 13 = Ignition coil 2 term. 15  
 14 = Start-disable backup light switch term. 50/  
 jumper to ground on manual transmission  
 15 = Steering lock term. 50  
 16 = Tachometer  
 17 = Pump fuse  
 18 = Pump relay  
 19 = Power-supply relay

20 = Main relay  
 21 = Starting relay  
 22 = Kick-down relay  
 A, F, J, K, M, Q and W =  
 10-pin plugs in central-  
 electrics box  
 23 = Magnetic clutch (compressor)  
 low-pressure switch - solenoid-operated air valve  
 24 = Evaporator thermo-switch -  
 anti-icing

**A16**

Electrical terminal diagram  
 Porsche 928 S USA



**A17**

Electrical terminal diagram  
 Porsche 928 S USA



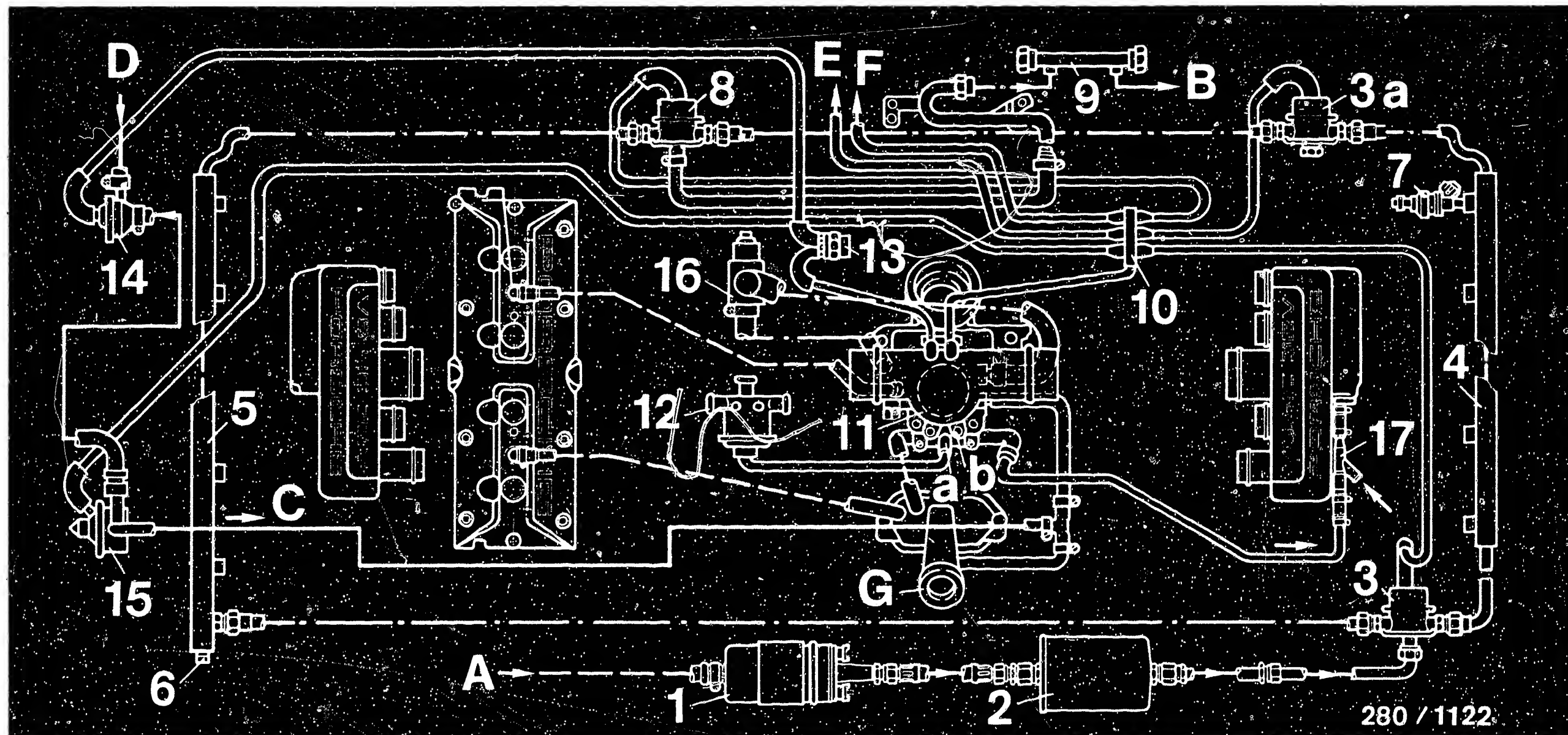


Diagram of fuel lines

- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Pressure damper
- 3a = Pressure damper
- 4 = Left-hand fuel-distribution pipe (cyl. 5-8)
- 5 = Right-hand fuel-distribution pipe (cyl. 1-4)

- 6 = Pressure gauge test connection
- 7 = Injection valves
- 8 = Pressure regulator
- 9 = Fuel cooler
- 10 = Vacuum distributor
- 11 = Throttle-valve housing
- 12 = Blow-off change-over valve
- 13 = Thermo-valve

- 14 = Switching valve
- 15 = Control valve
- 16 = Idle actuator
- 17 = Sucking jet pump
- a = Vacuum connection 49 states
- b = Vacuum connection California

- A = from fuel tank
- B = to fuel tank
- C = Vent to oil filler neck
- D = from active-carbon container
- E = to automatic transmission
- F = to EZ control unit
- G = Oil filler neck

**A18**

Diagram of fuel lines  
Porsche 928 S USA

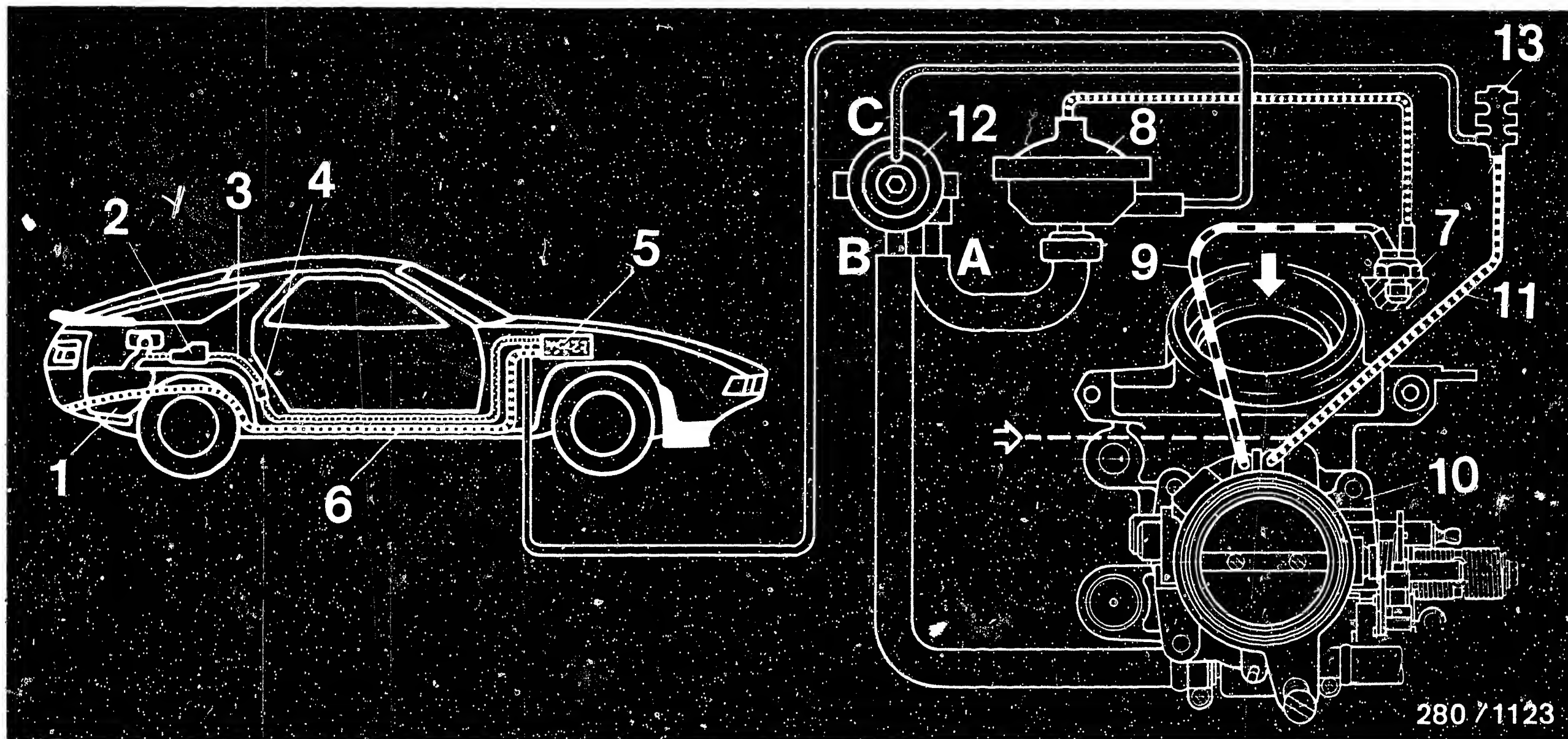


**A19**

Diagram of fuel lines  
Porsche 928 S USA







### Tank ventilation system

- |                          |                               |
|--------------------------|-------------------------------|
| 1 = Fuel tank            | 9 = Vacuum line               |
| 2 = Expansion tank       | 10 = Throttle-valve housing   |
| 3 = Vent line            | 11 = Vacuum line              |
| 4 = Roll-over valve      | 12 = Control valve            |
| 5 = Active-carbon filter | 13 = Vacuum distributor       |
| 6 = Air-admission line   | A = from active-carbon filter |
| 7 = Thermo-valve         | B = to throttle-valve housing |
| 8 = Switching valve      | C = Vacuum connection         |

**General:** The closed tank-ventilation system with active-carbon filter is also used in conjunction with the catalytic converter and lambda closed-loop control.

**Principle:** With the engine stopped, the gases from the fuel tank pass through the expansion tank, the roll-over valve to the active-carbon filter which is in the wheel housing at the front right. The sucking off of the fuel vapors and the admission of air to the active-carbon filter is monitored by 3 valves.

Continued on A 22

**A20**

Tank-ventilation system  
Porsche 928 S USA



**A21**

Tank-ventilation system  
Porsche 928 S USA



## Tank-ventilation system (continued)

### 1. The thermo-valve

opens the vacuum connection to the switching valve when a temperature of +58°C is reached.

### 2. The switching valve

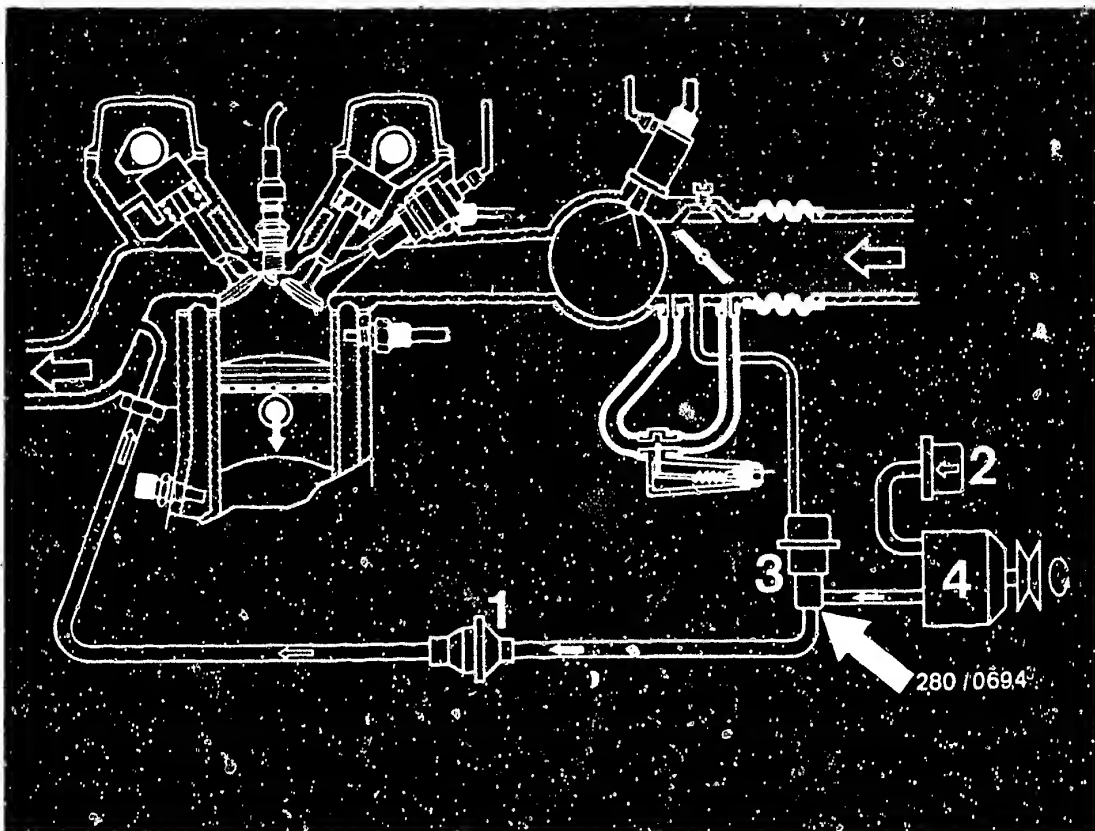
opens and closes the connection between the active-carbon filter and the control valve.

### 3. The control valve

operates as a function of the throttle position.

If the throttle valve is closed, the control valve is also closed. It opens as the throttle opening increases. This guarantees that the fuel vapors are drawn in from the active-carbon filter only when the engine temperature is above +58°C with the engine operating at least in the part-load range.





1 = Non-return valve  
2 = Air filter for air pump

3 = Blow-off change-over valve  
4 = Air pump

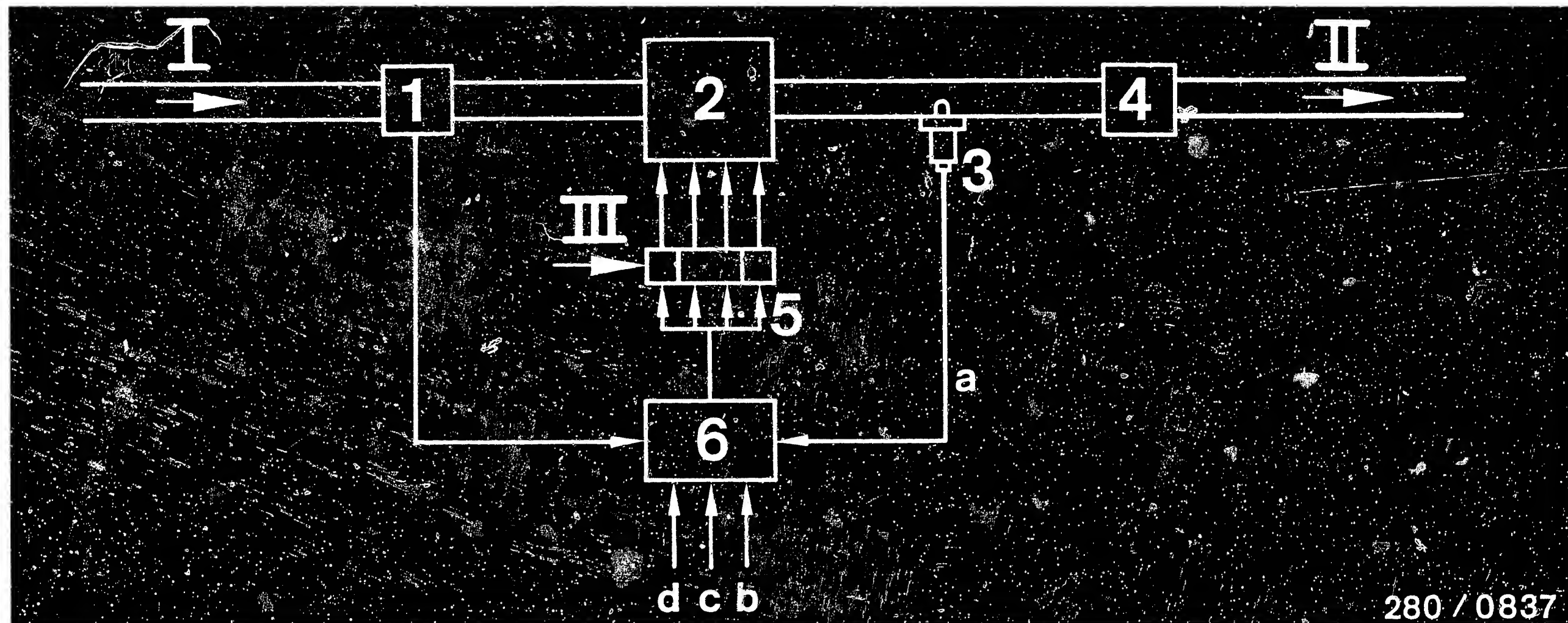
### SECONDARY-AIR INJECTION

Operating principle (general):

An engine-driven air pump draws fresh air in through the air filter and blows it into the exhaust ports through a non-return valve. This results in partial afterburning of the CO and HC constituents in the exhaust gas. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system (to prevent overloading of the air pump at high exhaust back-pressures, the auxiliary air is directed by the change-over valve into the air filter as of an intake manifold vacuum of approx. 60 mbar).

Render the air injection system inoperative for checking/adjusting the idle speed and CO (seal outlet of Item 3 (see arrow)).





280 / 0837

1 = Air-flow sensor  
2 = Engine  
3 = Lambda sensor  
4 = 3-way catalytic converter

5 = Solenoid-operated injection valves  
6 = LH-control unit with lambda closed-loop control

a = Sensor voltage  
b = Supply voltage  
c = Engine speed  
d = Engine temperature

I = Air  
II = Exhaust gas  
III = Fuel

#### OPERATION OF THE LAMBDA CLOSED-LOOP CONTROL

Using the closed-loop control circuit which is closed using a special sensor - the lambda sensor - deviations from a given air/fuel ratio can be identified and corrected. The control principle is based on measurement of the remaining oxygen level in the exhaust gas continually with the lambda sensor. This oxygen level is an indicator for the composition of the air/fuel mixture being supplied to the engine. As a sensor in the exhaust pipe, the lambda sensor provides information as to whether the mixture is richer or leaner than  $\lambda = 1$ . The lambda sensor reports this deviation to the control unit, and the lambda closed-loop control (in the control unit) acts upon the fuel-injection duration as precalculated by the injection control or on the amount of fuel injected. This control to  $\lambda = 1$  is a prerequisite that enables the subsequent 3-way catalytic converter to burn the toxic substances efficiently.

**B1**

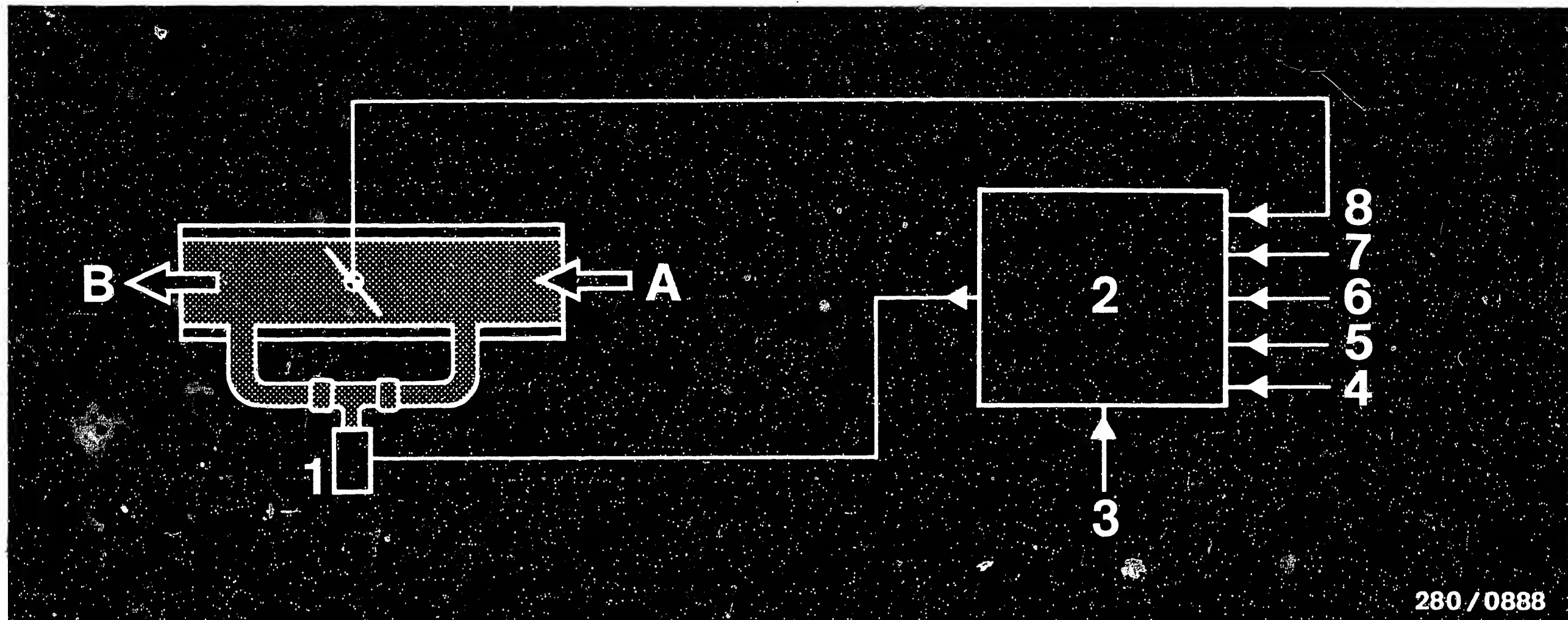
Lambda closed-loop control  
Porsche 928 S USA



**B2**

Lambda closed-loop control  
Porsche 928 S USA





280 / 0888

- |                                       |                        |                          |                         |
|---------------------------------------|------------------------|--------------------------|-------------------------|
| 1 = Idle actuator                     | 4 = Supply voltage     | 7 = Engine speed         | A = From the air filter |
| 2 = Idle controller (LH-control unit) | 5 = Set value switch   | 8 = Idle contact         | B = To the engine       |
| 3 = Test pin                          | 6 = Engine temperature | of throttle valve switch |                         |

#### Operation of the idle speed control (LFR)

Using the LFR, it is possible to attain a constant engine idle behavior under all conditions that is favorable with regard to emissions and fuel consumption. Dips in engine speed are avoided when, for example, the air conditioner, power steering, or, with automatic transmissions, the drive are switched on. The wiring for this installation is accommodated in the LH-control unit. The idle actuator is in place of the auxiliary-air device otherwise needed.

#### Advantages

- Constant idle speed under all operating conditions.
- Reduced fuel consumption due to reduction in idle speed.
- No readjustment of idle speed required.
- Secondary air valves for power steering or air conditioner not required.
- Speed increase (switching on air conditioner) is possible.

- Testing: The electrical test and functional test are done with the universal test adapter. Testing of the idle speed control is included in the test sequence for the LH-Jetronic. An adapter lead is used for testing the LH-Jetronic and the idle speed control. Run the pneumatic test of the idle actuator the same way as for the auxiliary-air device.

**B3**

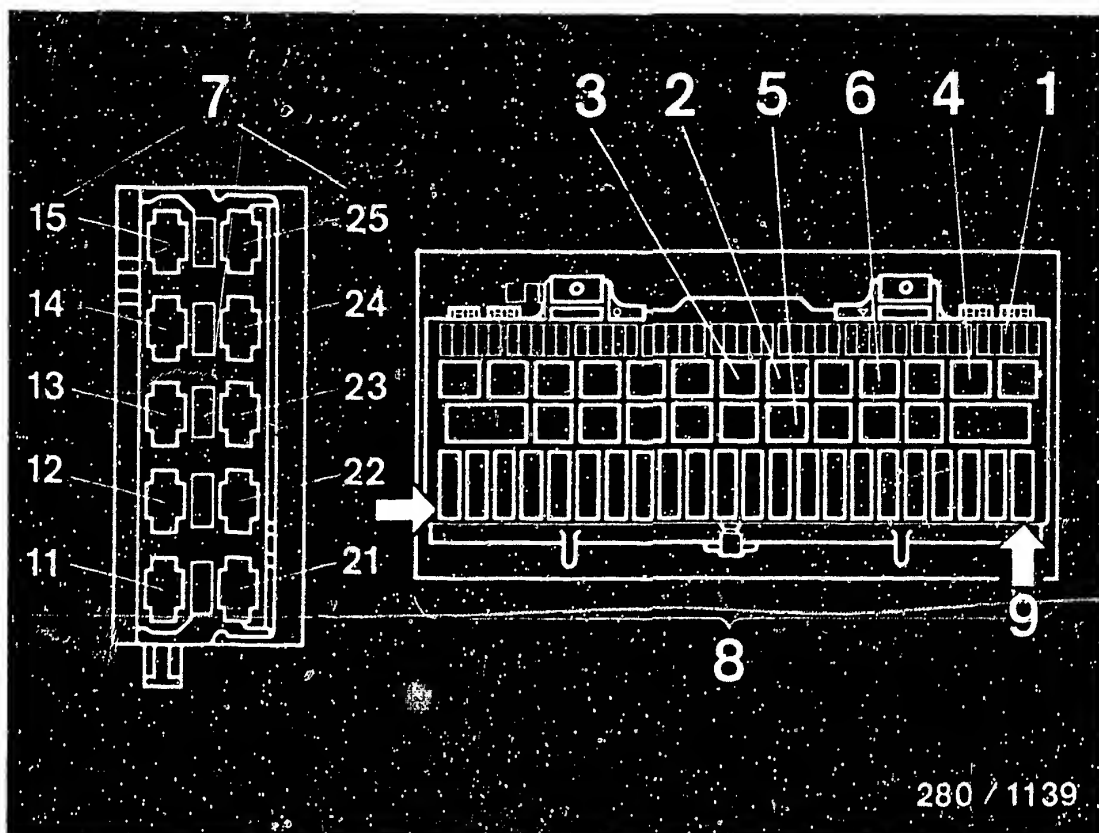
Idle speed control  
Porsche 928 S USA



**B4**

Idle speed control  
Porsche 928 S USA





280 / 1139

### CENTRAL-ELECTRICS BOX

(Arrangement of relays, fuses and plug connectors)

#### Installation position:

Behind front passenger footwell cover plate, take away floor mat and hinge up running plate.

- 1 = Pump fuse (No. 42)
- 2 = Power supply relay
- 3 = Starting relay
- 4 = Main relay
- 5 = Kick-down relay
- 6 = Pump relay
- 7 = Pin numbering
- 8 = Central-electrics box plug
- 9 = Central-electrics box plug W





## TEST EQUIPMENT AND TOOLS

<u>Description</u>	<u>Designation</u>	<u>Part No.</u>
Universal test adapter	ETT 018.01	0 684 101 801
Adapter lead		1 684 463 141
Lambda closed-loop tester		KDJE P600
Pocket tester	KTE 001.03	0 684 400 103
Motortester	e.g. MOT 002.00	0 684 000 200
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Test lead		1 684 463 093
Exhaust-gas analyzer calibrated	e.g. ETT 008.00	0 684 100 800
	ETT 008.04	0 684 100 804
	ETT 008.05	0 684 100 805
Non-return valve for electric fuel pump parts set		1 587 010 002
Jetronic case		KDJE K-100
Pressure tester		KDJE-P 100
Pressure tester (no longer available)		KDEP 1034
Electrics tester or multimeter e.g.	ETE 014.00	0 684 101 400
	Philips	PM 2517 X
	Miselco	Master 50 K
	Fluke	Multimeter 75
Hexagon pin wrench for idle adjustment A/F 7		e.g. Hazet 428-7
Hexagon wrench for CO adjustment (jointed screwdriver) A/F 3	9230	Porsche part no. 00 721 923 00
Porsche		
Solenoid-operated injection valve		0 280 150 252
Parts set		0 287 010 704

Use suitable, commercially available tools for removing and fitting the idle CO anti-tamper device on the air-mass sensor.

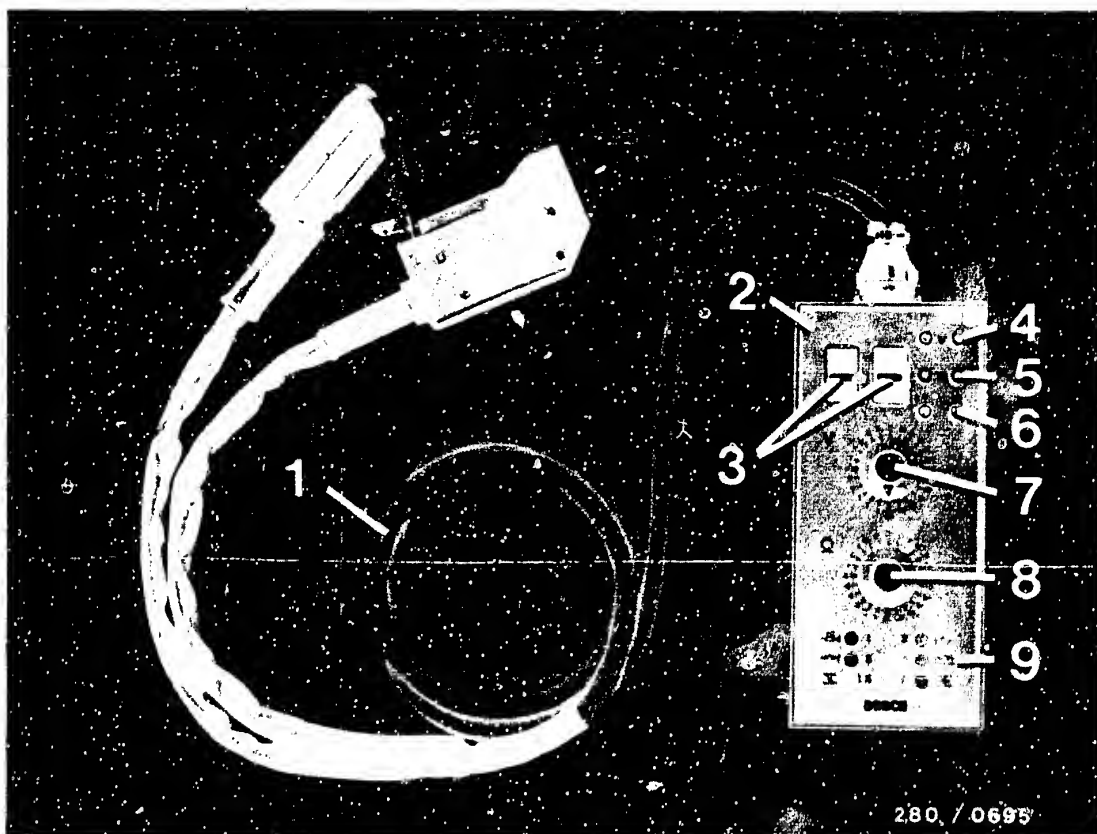
**B6**

Test equipment and tools

Porsche 928 S USA







- 1 = Adapter lead (Part No.: 1 684 463 141)
- 2 = Universal test adapter (Part No.: 0 684 101 801)
- 3 = Test wells (for motor tester)
- 4 = Test sockets (for measurements of voltage)
- 5 = Test sockets (for measurements of resistance)
- 6 = Test sockets (for dwell angle tester)
- 7 = "Volt" program switch
- 8 = "Ohm" program switch
- 9 = Buttons
  - Buttons 1 and 2: Temperature sensors, cold and warm
  - Buttons 3 and 4: Button for ground or voltage supply
  - Buttons 5 and 6: Simulation of idle or full load

• Universal test adapter with adapter lead for LH-Jetronic.

### Connection:

The figure at the right shows the two test set-ups in connection with the universal test adapter. From top to bottom:

- Test set-up with a motortester (1)
- Test set-up of the universal test adapter (8) with the LH-adapter lead (13).
- Test set-up with a multimeter (14) and/or a dwell angle tester (15).

The broken lines indicate the test set-ups that are optionally possible.

- Connect the universal test adapter (8)
- Connect LH-adapter lead (13) to the universal test adapter.
- Disconnect the control unit plug (9) of the Jetronic wiring harness from the control unit and connect it to the wiring harness plug (10) of the adapter lead.
- Plug the control unit plug (11) of the adapter lead on the control unit (12).  
(Please follow instructions in the individual test steps.)

### Test set-up for testing with a motortester (1):

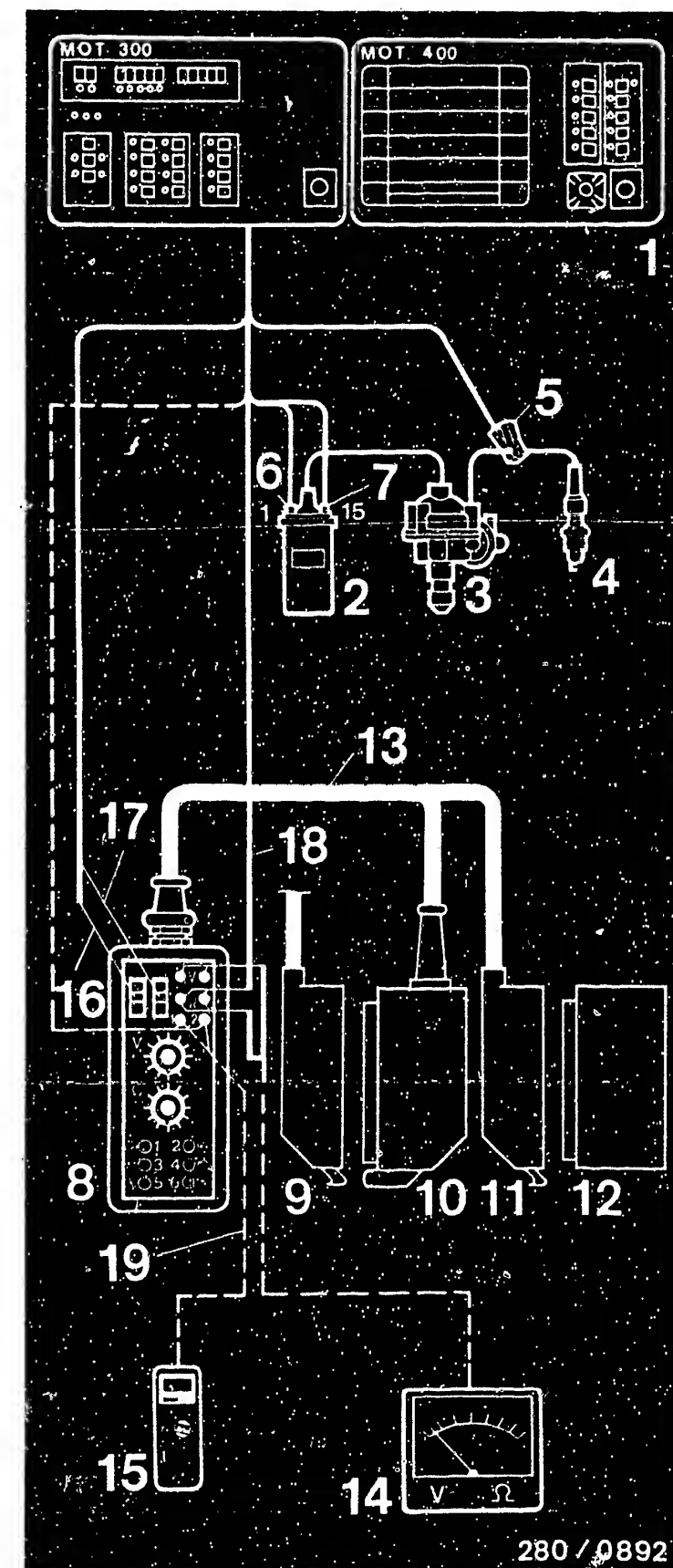
- Clamp-on induction pick-up (5) on the ignition lead of cylinder 1 (4) (close to the distributor) (3).
- Red terminal (16) in the red connection terminal.
- Black terminal (17) in the black connection terminal.
- Lead for measuring resistance (18) with red and black test prod at the blue sockets.
- Connect green (6) and yellow (7) clips to sockets 1 and 2 on the universal test adapter for measurement of dwell angle.

### Test set-up for testing with a multimeter (14) $R_i = \min. 20 \text{ k}\Omega/\text{V}$

- Measurement of resistance  
Multimeter (14) in setting  $\Omega$ , or plug measuring leads into the connections for measurement of resistance and plug the test leads on the universal test adapter into the blue test sockets.
- Measurement of voltage  
Multimeter (14) in setting V, or plug measuring lead into the connections for measurement of voltage and plug the test leads on the universal test adapter into the red and black test sockets. (Watch polarity.)
- Measurement of dwell angle  
Pocket-tester (15) at setting dwell angle 100%.  
Connect connecting lead (19) to sockets 1 and 2 on the universal test adapter.

### Caution!

Plug in and unplug the universal test adapter only while the ignition is switched off.

**B8**

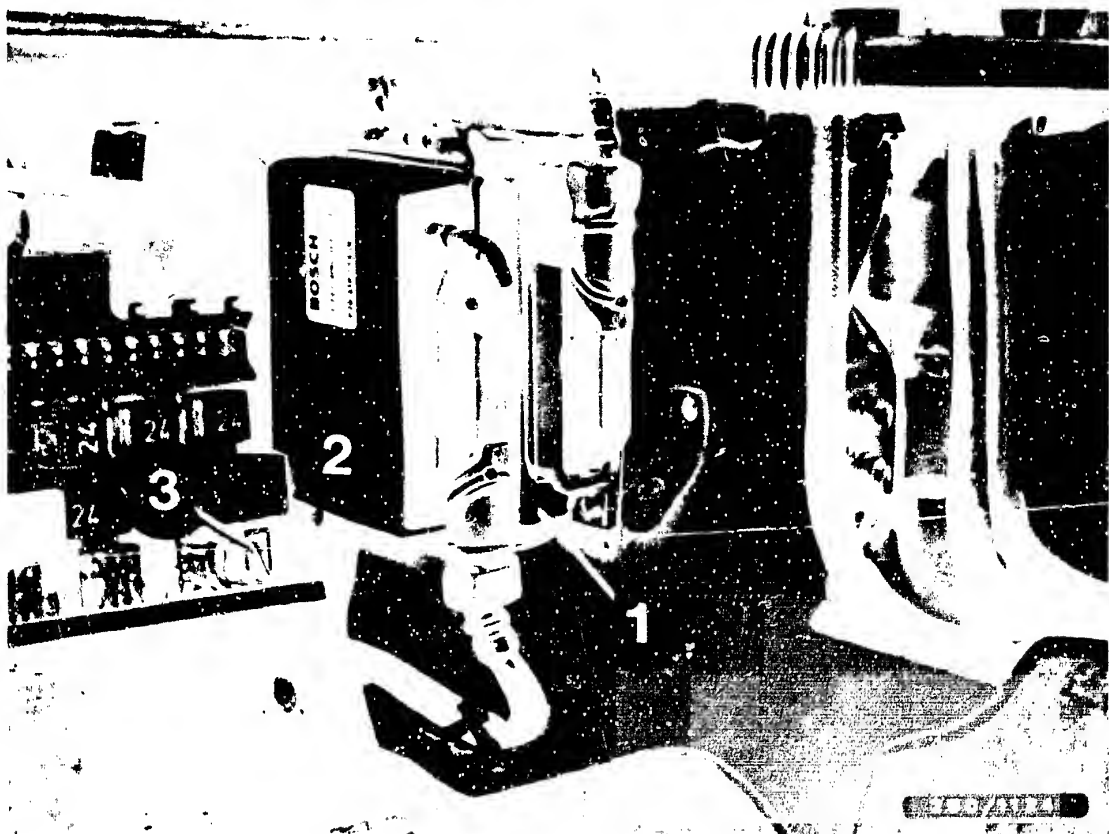
Test chart for universal test adapter  
Porsche 928 S USA

**B9**

Test chart for universal test adapter  
Porsche 928 S USA



280 / 0892



similar to 928 s

1 = LH control unit

2 = Electronic-ignition (EZ) control unit

3 = Central-electrics box plug "W"

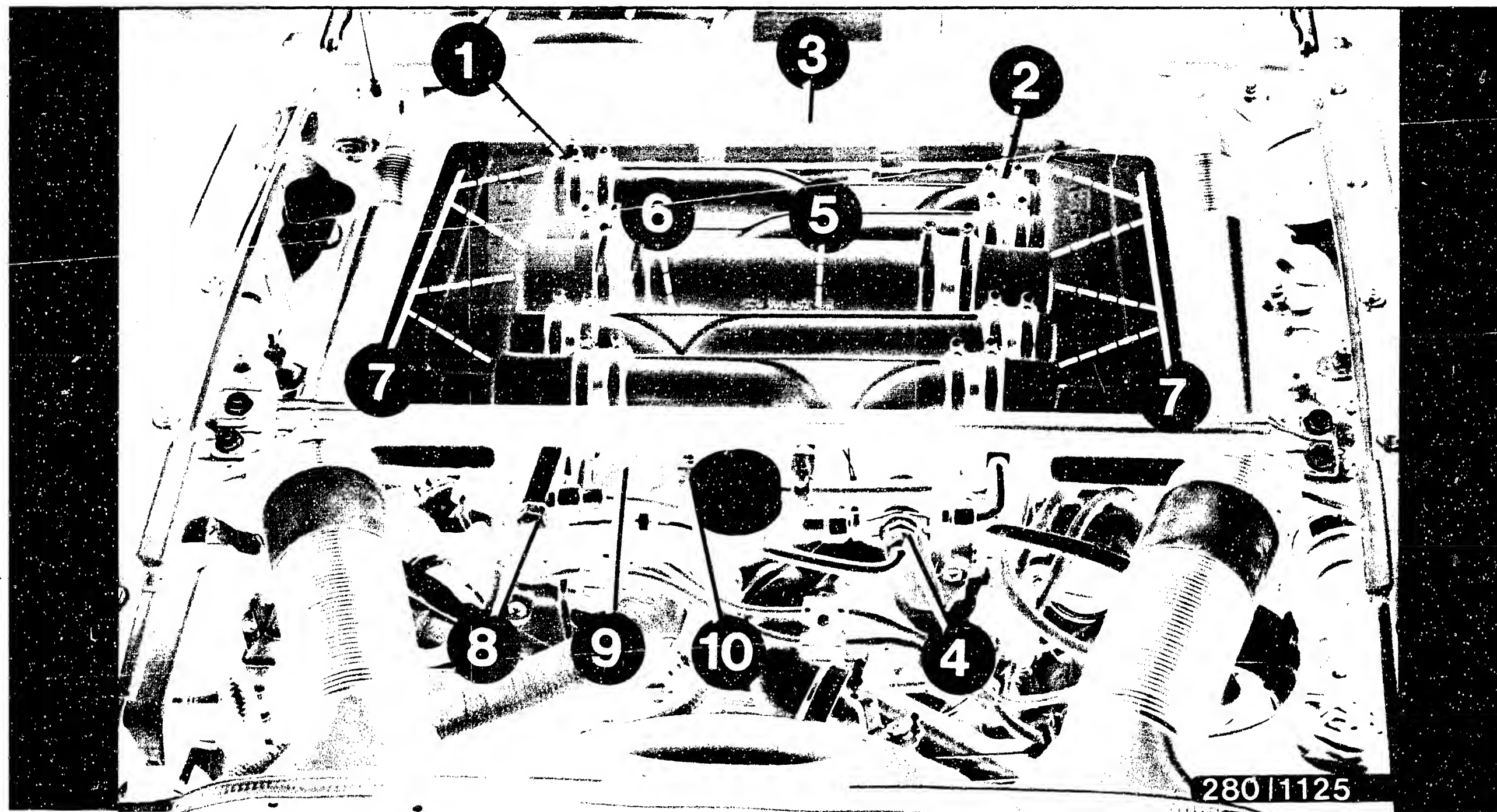
To connect the universal test adapter, disconnect 25-pin control-unit plug. To do this, press detent upward.

#### INSTALLATION POSITION OF COMPONENTS

The indications (right) and (left) always refer to the forward direction of travel.

The control unit is in the passenger compartment, on the right in the front-passenger footwell behind the foot-plate.





# Installation position of components (continued)

- |   |   |  |
|---|---|--|
| 1 = Pressure regulator                      | 5 = Hot-wire air-mass sensor                | 9 = Test socket (idle-speed control, lambda closed-loop control) (in standard production: upright to right of oil filler neck) |
| 2 = Ground terminal (under pressure damper) | 6 = Idle actuator                           | 10 = Double temperature sensor   |
| 3 = Air filter                              | 7 = Injection valves                        | 1 x engine temperature - Jetronic  |
| 4 = Pressure damper                         | 8 = Test connection for fuel pressure gauge | 1 x engine temperature - Ignition system   |

**B11**

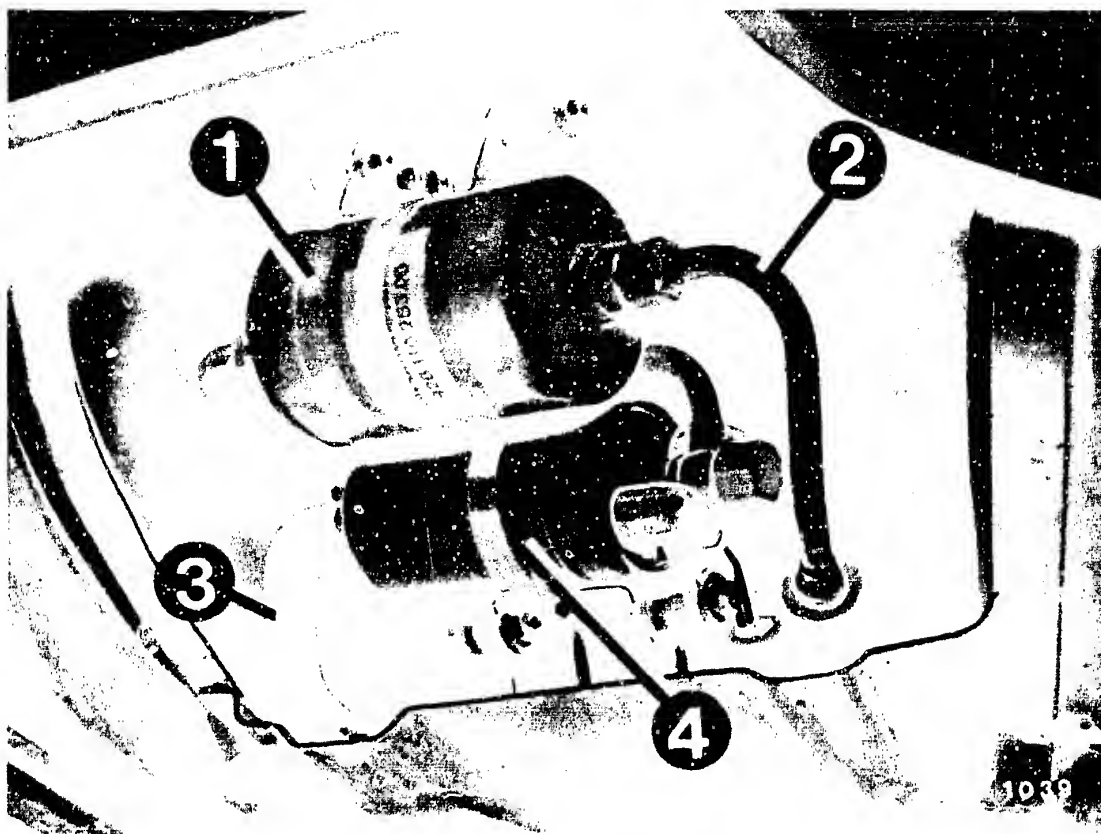
Installation of components  
Porsche 928 S USA



**B12**

Installation of components  
Porsche 928 S USA

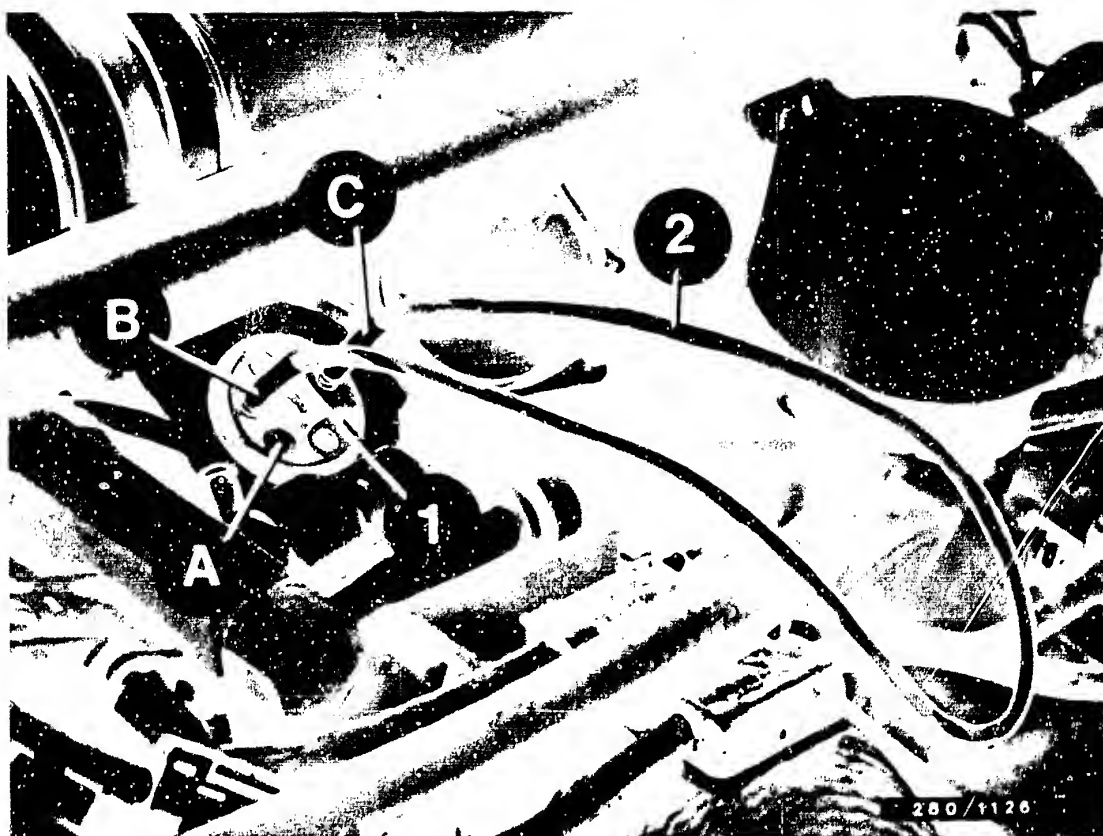




- 1 = Fuel filter
- 2 = Fuel delivery line
- 3 = Fuel intake line
- 4 = Electric fuel pump

Installation position of components (continued)





- 1 = Test socket
- 2 = Test lead (user-fabricated)
- A = Test output - lambda closed-loop control integrator
- B = Test output - idle-speed control (test pin)
- C = Test output - ground

Installation position of components (continued)



## IMPORTANT GENERAL INFORMATION

- Never start engine without battery connected.
- Do not use starting aids with more than 16 V.
- Never disconnect battery with engine running.
- Disconnect battery from vehicle electrical system for fast charging.
- Remove control unit at temperatures above 80°C (paint-drying installation).
- Make sure that all connectors of the wiring harness are properly seated.
- Never connect or disconnect the control-unit plug with the ignition on.
- When testing compression, cut the power supply by disconnecting the main relay. This prevents undesired injecting.
- Remove Jetronic control unit before carrying out electrical welding work (e.g. spot welding).
- If an alarm system is installed, proceed according to SIS microcard ALL-500.
- For the following trouble-shooting, it is assumed that engine, ignition and electrical system are O.K.
- Supplementary descriptions on L-Jetronic:
  - VDT - U3/3
  - VDT-I-280/...





## TROUBLE-SHOOTING CHARTS

Using the universal test adapter with adapter lead (1 684 463 141) and other suitable testers, the following trouble-shooting charts are intended to enable the workshop employees to quickly detect causes of trouble on the LH-Jetronic. A choice can be made between the following procedures depending on the level of training and experience of the employee:

- Detailed, step-by-step trouble-shooting chart

For employees with little experience or practice on vehicles equipped with LH-Jetronic. There is a complete trouble-shooting program for each customer complaint.

- Pin-pointed, direct trouble-shooting chart

For trained and experienced employees with a great deal of practice on vehicles equipped with version LH2. Trouble-shooting according to customer complaint starts on a specific component within the trouble-shooting program.

Both trouble-shooting charts begin by checking the electrical/electronic part of the LH-Jetronic with the aid of the universal test adapter with adapter lead. This quickly checks the electrical operation of the wiring harness with the components connected to it, and faults are quickly detected.

If no fault is found with the universal test adapter, it is necessary to perform the fuel pressure test.

If once again no fault is found, continue with the detailed or direct trouble-shooting chart.

**C3**

**C5**

**C1**

Trouble-shooting chart  
Porsche 928 S USA



**C2**

Trouble-shooting chart  
Porsche 928 S USA



1. Detailed, step-by-step trouble-shooting chart for the complete trouble-shooting program

- Electrical test with universal test adapter, adapter lead 1 684 463 141 and motortester/multimeter (Coordinates C9...F9).

- Fuel pressure test with pressure gauge

This test must come immediately after the test with the universal test adapter and must be performed from beginning to end (Coordinates F8...F21)

- Trouble-shooting according to customer complaints (fault symptoms)

The table below contains possible fault symptoms and the right-hand column gives the first coordinate of the respective detailed trouble-shooting program.

This trouble-shooting program consists of logically ordered test procedures for all individual components of the LH-Jetronic. If, after completing the trouble-shooting program for an assumed symptom, the fault has not been detected or remedied, choose a new fault symptom and work through a different program.

<u>Customer complaints (fault symptoms)</u>	<u>Electrical test with universal test adapter</u>	<u>Fuel pressure test with pressure gauge</u>	<u>Trouble-shooting program</u>
1. Starting motor operates, engine fails to start or starts only with great difficulty	C 9	F 8	G 1
2. Engine starts but then dies	C 9	F 8	H 1
3. Rough idle/incorrect idle speed	C 9	F 8	H 15
4. Poor throttle take-up	C 9	F 8	J 5
5. Engine missing under all operating conditions	C 9	F 8	K 1
6. Fuel consumption too high	C 9	F 8	L 1
7. Maximum engine power/top speed not reached	C 9	F 8	L 13
8. Idle speed and CO concentration too low or too high	C 9	F 8	M 5

**C3**

Trouble-shooting chart

Porsche 928 S USA



**C4**

Trouble-shooting chart

Porsche 928 S USA



## 2. Pin-pointed, direct trouble-shooting chart, for components within the trouble-shooting programs

- Electrical test with universal test adapter, adapter lead 1 684 463 141 and motortester/multimeter

The test with the universal test adapter must come at the beginning of the test program and must be performed from beginning to end (Coordinates C9...F7).

- Fuel pressure test with pressure gauge

The fuel pressure test must come immediately after the test with the universal test adapter and must be performed from beginning to end (Coordinates F8...F21).

- Trouble-shooting according to customer complaint

The table below contains various fault symptoms with several possible causes of the fault in each case. The reference panel indicates the first coordinate of the test procedure for the respective individual components of the LH-Jetronic. If, after testing the individual components, the fault has not been detected or remedied, choose a new fault symptom.

### Customer complaints (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty								
2. Engine starts but then dies								
3. Rough idle/incorrect idle speed								
4. Poor throttle take-up								
5. Engine missing under all operating conditions								
6. Fuel consumption too high								
7. Maximum engine power/top speed not reached								
8. Idle speed and CO concentration too low or too high								
<u>Cause</u> (component fault)								
C9	C9	C9	C9	C9	C9	C9	C9	Fault in electrics; test with universal test adapter
F8	F8	F8	F8	F8	F8	F8	F8	Fault in fuel supply. Pressure regulator defective. Pump relay defective. Pump fuse defective. poor ground connection of electric fuel pump. Electric fuel pump not operating. Fuel pressure test.
G7	H3	H19	J9				M7	Idle actuator mechanically defective
G13	H5		J11	K3	L3	L19		Hot-wire air-mass sensor defective (removal and installation)
	H9						M17	Injection valves leaking

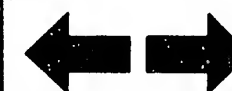
**C5**

Trouble-shooting chart  
Porsche 928 S USA



**C6**

Trouble-shooting chart  
Porsche 928 S USA



# Customer complaints (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Rough idle/incorrect idle speed
4. Poor throttle take-up
5. Engine missing under all operating conditions
6. Fuel consumption too high
7. Maximum engine power/top speed not reached
8. Idle speed and CO concentration too low or too high

## Cause (component fault)

G3							M13	Cold-start control defective
G17	H11	J1	J15				M1 M19	Air-intake system leaking, hose lines defective
G9		H21		K13	L7			Injection valves defective; connect test lead (removal and installation)
				K7		L17		Delivery of electric fuel pump insufficient
		H17	J7	K9				Throttle valve not closing; adjustment of throttle-valve switch incorrect
						L15		Throttle valve not opening fully
				K11				Overrun cutoff
				K3				Open circuit in wiring harness and plug-in connections, interference, missing, ground contact
						L23		Catalytic converter
				K9				Control unit defective

C7

Trouble-shooting chart  
Porsche 928 S USA



C8

Trouble-shooting chart  
Porsche 928 S USA



# TEST CHART FOR UNIVERSAL TEST ADAPTER

with connected adapter lead 1 684 463 141

LH-Jetronic in Porsche 928 S, 32-valve engine, US version, as of 12.84

- Before testing with the universal test adapter, check all multiple plug connections for loose contacts.  
Clean dirty or corroded contacts.
- Watch for receptacle which has been pushed back.  
If necessary, bend back locking tab and press receptacle into plug housing as far as it will go. Locking tab latches.
- Suspicion of line breaks in case of kinking and pinching.

Installation position of control unit: Front passenger footwell at bottom right on A-pillar, behind the foot-plate.

The universal test adapter checks the peripherals of the electrics and, by means of a functional test, also the LH control unit. Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead. Connect free end of adapter lead to control unit (ignition must be off). Connect a motortester or multimeter for voltage and resistance measurements to the universal test adapter in order to take the measurements.

Caution: Since the adapter lead has to be connected differently for testing the peripherals and for the functional test, follow the instructions in the test chart.

The individual test steps are selected by means of two program switches (one for voltage measurements, the other for resistance measurements). Each program switch has 24 test settings, only some of which, however, are assigned for the LH version.

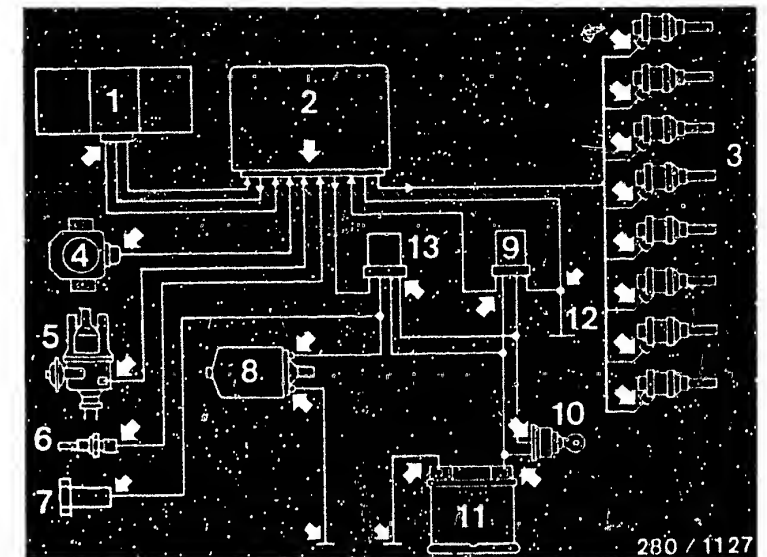
If a fault is found during a test, the test must be repeated after the fault has been remedied.

The test with the universal test adapter must always be performed from beginning to end.

Be sure to follow the instructions in the test chart

- Test steps 1...10 measure resistances. Set motortester/multimeter to "resistance measuring range".
- Test steps 11...15 measure voltages during starting and with ignition "ON". Set motortester/multimeter to "voltage measuring range".
- Test steps 16...29 are tests with the engine running.

Test specifications and operating instructions for the universal test adapter are given in the following test chart.



Electrical plug-in connections (arrows)

- 1 = Hot-wire air-mass sensor
- 2 = Control unit
- 3 = Injection valves
- 4 = Throttle-valve switch
- 5 = Ignition distributor
- 6 = Temperature sensor (engine)
- 7 = Idle actuator
- 8 = Electric fuel pump
- 9 = Main relay
- 10 = Ignition lock
- 11 = Battery
- 12 = Central ground
- 13 = Pump relay

C9

Test chart for universal test adapter  
Porsche 928 S USA



C10

Test chart for universal test adapter  
Porsche 928 S USA



## Requirements for correct test procedure

1. Start testing with test step 1.
2. The sequence of test steps must be kept to. The trouble-shooting which is given builds on the trouble-shooting for the preceding test steps.

### Example:

When in test step 1 the ground connection term. 11 for the control unit is tested, this test is not repeated in the further test steps.

3. If an incorrect reading is indicated for a test step, this test step must be repeated after the fault has been remedied.

### Caution:

Test steps 1 to 15: Connect adapter lead to peripherals only.

Test steps 16 to 29: Connect adapter lead to control unit and peripherals.

### Note:

In the following test steps a white border in the "Operation" column indicates which operation has to be changed in comparison to the preceding test step.





TEST STEP 1 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate 1.45...3.3 k $\Omega$ at ambient temperature (+15°C...+30°C) and 280...360 $\Omega$ with engine at normal op. temp. (+80°C).	Component: Temperature sensor II (engine)
Program switch "Ω" at position	5		
Measuring equipment: Motortester or multimeter			Operation: Resistance between control unit term. 2 and electronics ground terminal
Measuring range: x 10 $\Omega$		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">             Yes ↓ Continue testing with next test step.           </div> <div style="text-align: center;">             No ↓           </div> </div>	Malfunction: Resistance not within tolerance
Connection: Blue test sockets			
Operation in vehicle: --			

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Measure resistance directly at engine temperature sensor (blue plug).

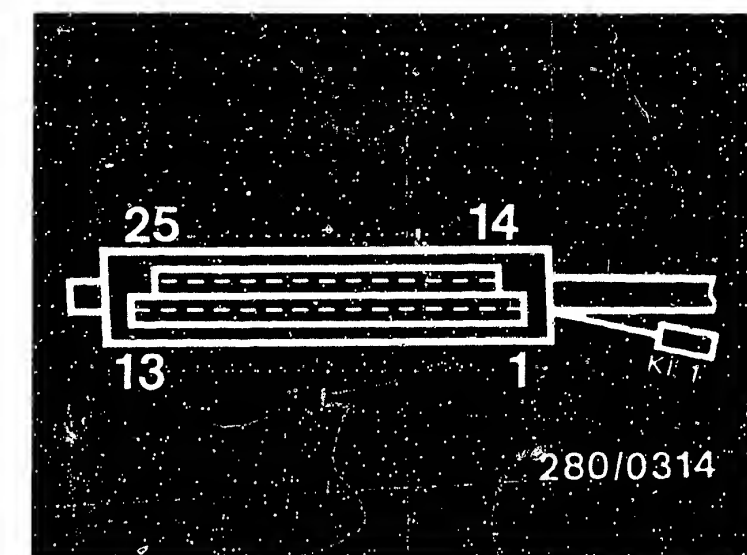
At ambient temperature (+15°C...+30°C): 1.45...3.3 k $\Omega$

With engine at normal op. temp. (approx. +80°C): 280...360  $\Omega$

Check the following leads for continuity with ohmmeter  
(Set value approx. 0  $\Omega$ ):

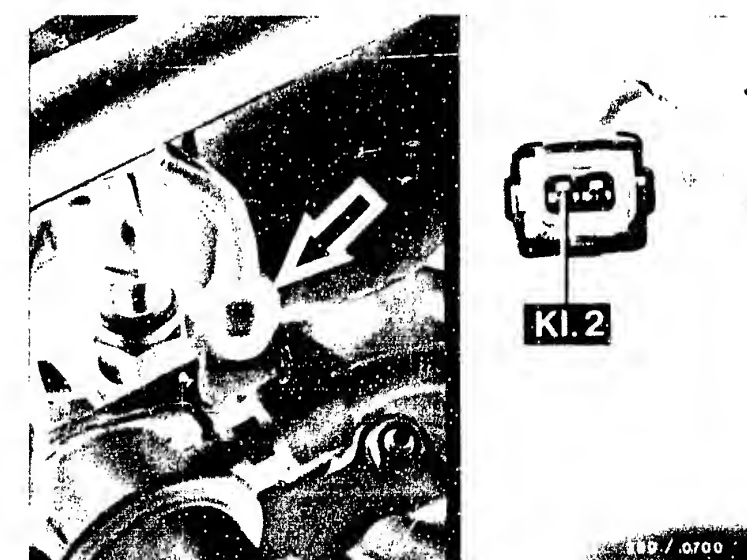
- From control-unit plug term. 2 to temperature sensor II (engine) term. 2.
- From control-unit plug term. 11 to electronics ground terminal  
(under rear pressure damper, left)

Eliminate contact resistances in the plug-in connections. Spring contacts must not allow themselves to be pushed back. If the measured resistance is not within tolerance - replace temperature sensor.



Top view of control-unit plug

Arrow = Temperature sensor II  
(LH-Jetronic)



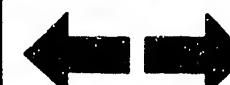
**C12**

Test chart for universal test adapter  
Porsche 928 S USA



**C13**

Test chart for universal test adapter  
Porsche 928 S USA





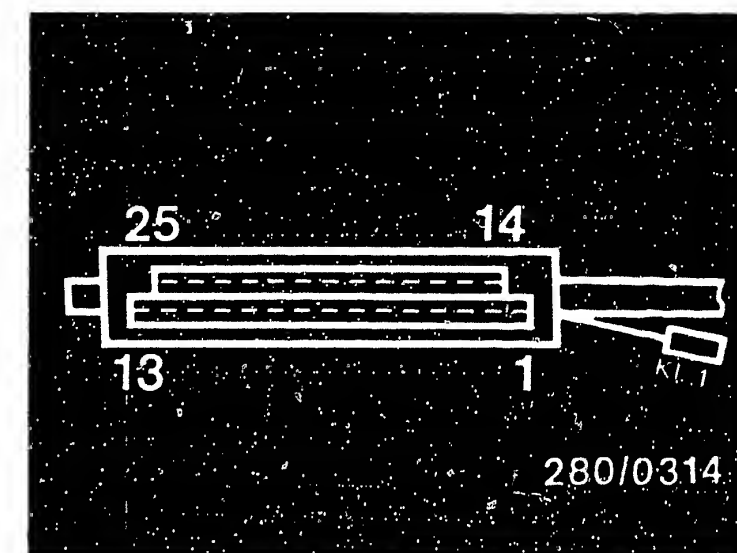
TEST STEP 2 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate	<u>Component:</u> Ground connection of output stage
Program switch "Ω" at position	6	0...10 Ω.	
Measuring equipment: Motortester or multi-meter			<u>Operation:</u> Ground connection of control unit term. 25
Measuring range: x 1 Ω			<u>Malfunction:</u> Resistance not within tolerance
Connection: Blue test sockets		Yes Continue testing with next test step.	
Operation in vehicle: --		No ↓	

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

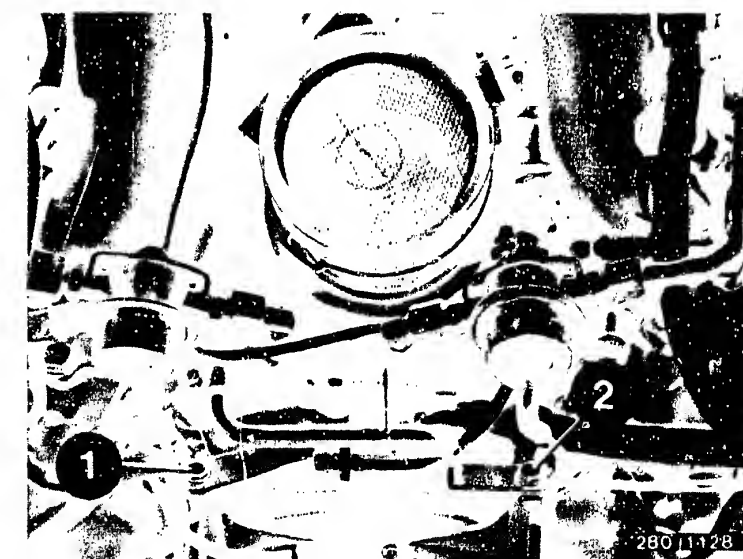
Check the following leads for continuity with ohmmeter  
(Set value approx. 0 Ω):

- From control-unit plug term. 25 to output stage ground terminal.
- Loosen ground screws. Clean connection. Re-tighten screw securely afterward.  
Eliminate contact resistances at the plug-in connections.



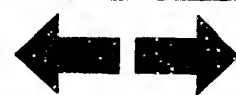
Top view of control-unit plug

2 = Output stage ground terminal



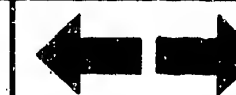
**C14**

Test chart for universal test adapter  
Porsche 928 S USA

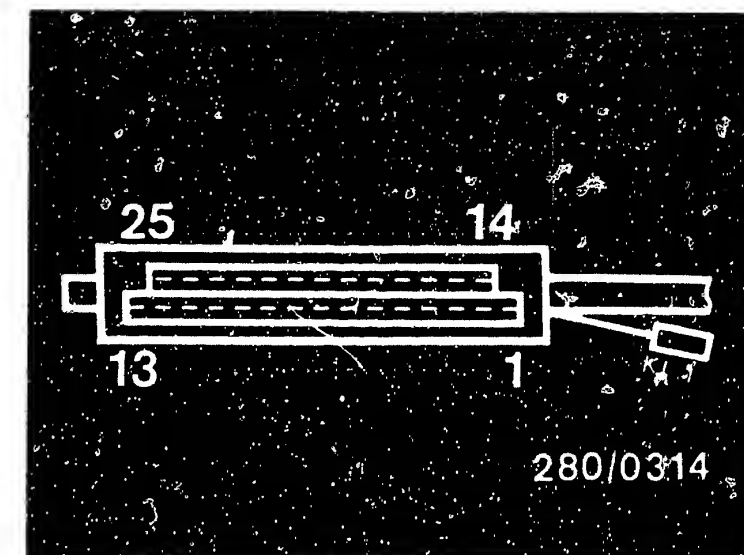


**C15**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 3 Connect adapter lead to peripherals only.			
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate  0...10 $\Omega$ .	Component: Ground connection of electronics ground terminal
Program switch " $\Omega$ " at position	7		
Measuring equipment: Motortester/multimeter			Operation: Ground connection of control unit term. 5
Measuring range: x 1 $\Omega$			
Connection: Blue test sockets		Yes	Malfunction: Resistance not within tolerance
Operation in vehicle: --		No	
		Continue testing with next test step.	



Top view of control-unit plug

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter  
(Set value approx. 0  $\Omega$ ):

- From control-unit plug term. 5 to electronics ground terminal.

Loosen ground screws. Clean connection. Re-tighten screw securely afterward.

Eliminate contact resistances at the plug-in connections.

1 = Electronic ground terminal



**C16**

Test chart for universal test adapter  
Porsche 928 S USA



**C17**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 4		Connect adapter lead to peripherals <u>only</u> .	
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate 6.00...8.20 Ω at ambient temperature (+15°C...+30°C) and 6.20...8.50 Ω with engine at normal op. temp. (+80°C).	Component: Solenoid-operated injection valves
Program switch "Ω" at position	8		Operation: Resistance of all 8 injection valves (in parallel) and electric fuel pump in series with them.
Measuring equipment: Motor- tester/multimeter			<div>yes</div> <div>Continue test- ing with <u>next</u> test step</div> <div>no</div> <div></div>
Measuring range: x 1 Ω			
Connection: Blue test sockets			
Operation in vehicle: --			
			Malfunction: Resistance not within tolerance

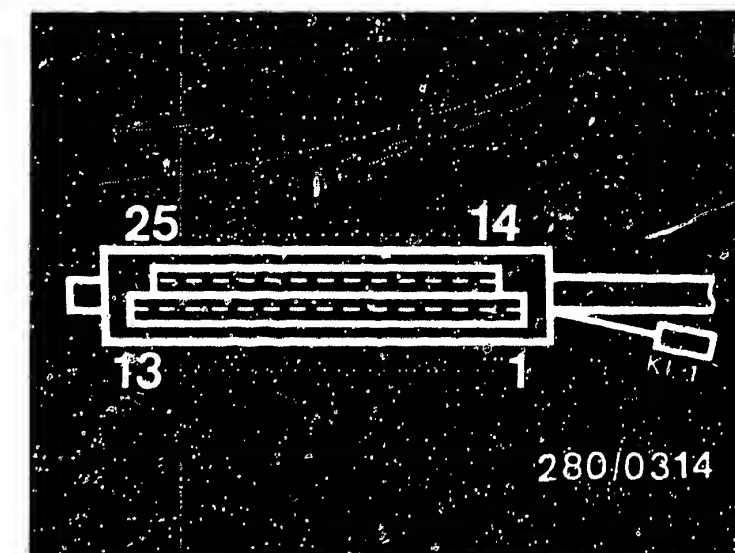
#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

If reading  $\infty\Omega$ : Pump fuse defective or all injection-valve connectors have open circuit (lead from control unit term. 13 dropped off).

- From control-unit plug term. 13 to the injection valves.
- From injection valves to central-electrics box plug W terminal number 13.
- From central-electrics box plug W term. no. 13 to pump relay (6) term. 87.
- From pump relay (6) term. 30 to central-electrics box plug U term. no. 12.
- From central-electrics box plug U term. no. 12 to battery term. 30 (positive terminal).
- From pump relay (6) term. 87 to pump fuse (1) no. 42.
- From pump fuse no. 42 to central-electrics box plug U term. no. 15
- From central-electrics box plug U term. no. 15 to electric fuel pump (positive terminal)
- From electric fuel pump (negative terminal) to ground on body. Ensure good ground connection (behind rear side panelling on right).

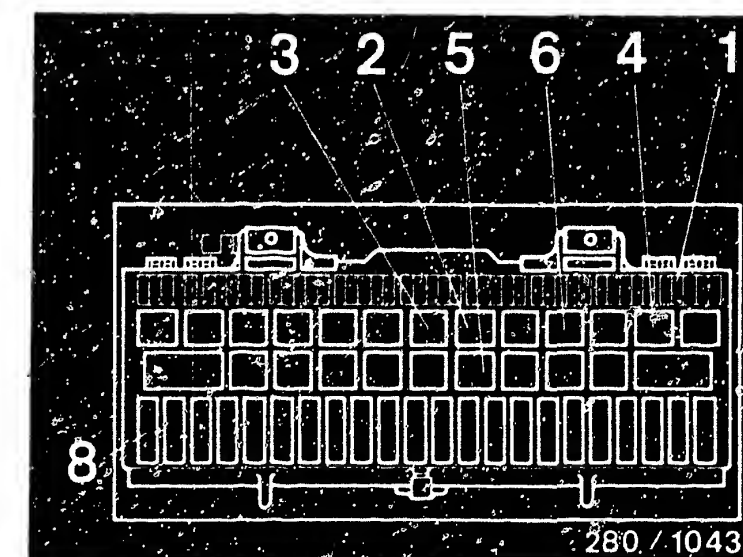
Continued on C 20



Top view of control-unit plug

#### Central-electrics box

- 1 = Pump fuse
- 2 = Pump relay
- 8 = Central-electrics box plug



**C18**

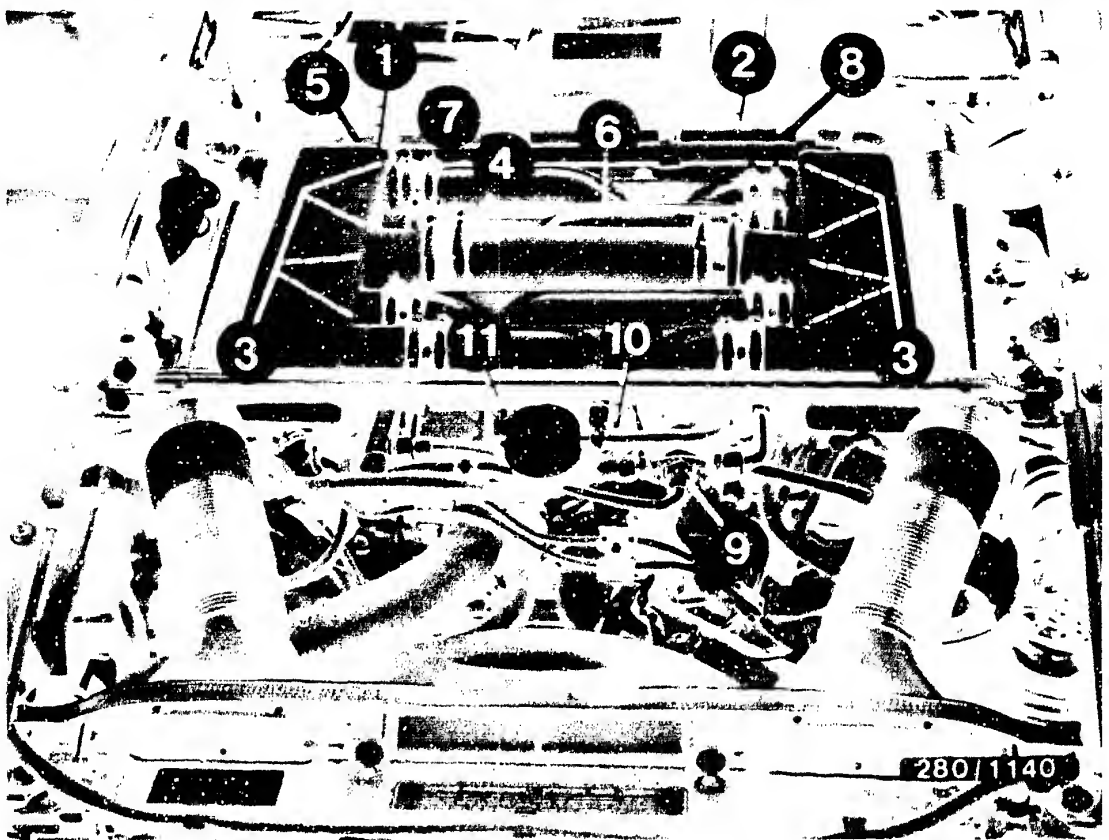
Test chart for universal test adapter  
Porsche 928 S USA



**C19**

Test chart for universal test adapter  
Porsche 928 S USA





2 = Solenoid-operated injection valves

Trouble-shooting - TEST STEP 4 (continued)

Resistance measurement at injection valve:

At ambient temperature (+15°C...+30°C):  $15...17.5 \Omega$

With engine at normal op. temp. (approx. +80°C):  $17...20 \Omega$

If reading too high: Valve coil has open circuit or a valve connector has dropped off.

Check seating of plug-in tabs.

Spring contacts must not allow themselves to be pushed back.

Installation position of components:

Electric fuel pump: Rear right, under a panel.



TEST STEP 5 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position		Measuring equipment must indicate  <u>0...10 Ω.</u>	<u>Component:</u> Throttle-valve switch (idle contact)
Program switch "Ω" at position			
Measuring equipment: Motor- tester/multimeter			<u>Operation:</u> Resistance Control-unit plug term. 3 to electronics ground terminal.
Measuring range: x 1 Ω			
Connection: Blue test sockets			
Operation in vehicle: Accelerator in rest position		Yes ↓  Continue test- ing with next test step.	<u>Malfunction:</u> Resistance not within tolerance

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

#### Adjusting the throttle-valve switch:

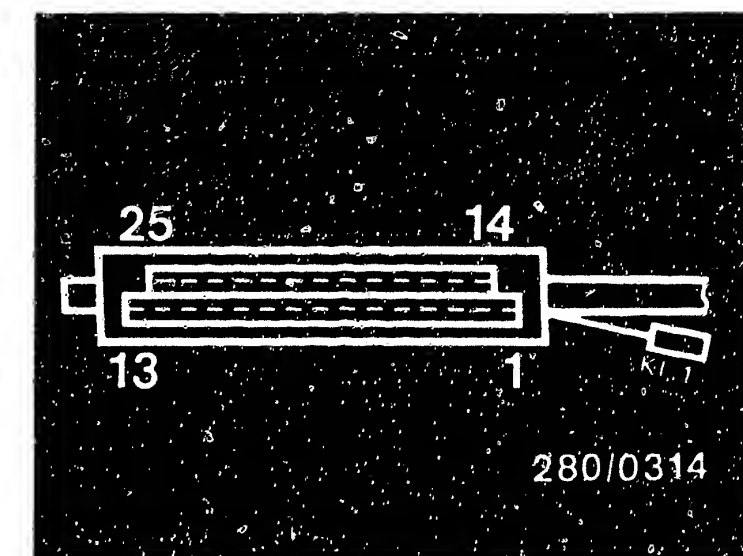
Slightly loosen throttle-valve switch fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch slightly to the right. Then to the left until the idle contact closes (microswitch clicks audibly). Reading approx. 0  $\Omega$ . Re-tighten fastening screws. If reading incorrect, replace throttle-valve switch.

Checking the adjustment: Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading  $\infty \Omega$ .

Check the following leads for continuity with ohmmeter

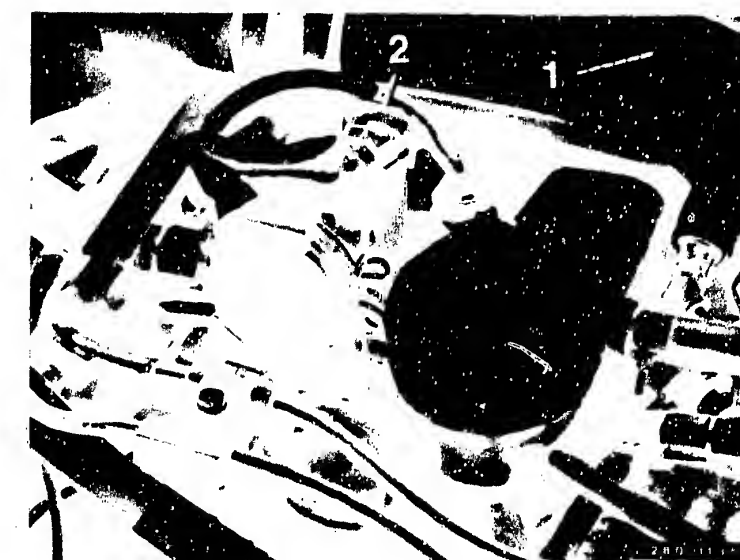
(Set value approx. 0  $\Omega$ ):

- From control-unit plug term. 3 to throttle-valve switch term. 2.
- From throttle-valve switch term. 18 (lead 48) to electronics ground terminal. (Under rear pressure damper, on left near engine firewall).
- Spring contacts must not allow themselves to be pushed back.
- Eliminate contact resistances in the plug-in connections.



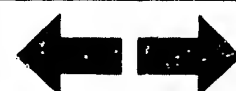
Top view of control-unit plug

- 1 = Throttle-valve switch
- 2 = Adapter plug for throttle-valve switch connecting lead (extension)



**C21**

Test chart for universal test adapter  
Porsche 928 S USA



**C22**

Test chart for universal test adapter  
Porsche 928 S USA





TEST STEP 6 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate  0...10 Ω.	Component: Throttle-valve switch (full-load contact)
Program switch "Ω" at position	10		
Measuring equipment: Motor-tester/multimeter			Operation: Resistance at control-unit plug term. 12 to electronics ground terminal.
Measuring range: x 1 Ω			
Connection: Blue test sockets			
Operation in vehicle: Accelerator in full-load position (pressed all the way down)		<div>Yes</div> <div>Continue testing with next test step.</div>	<div>No</div> <div>Malfunction: Resistance not within tolerance</div>

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (Set value approx. 0 Ω):

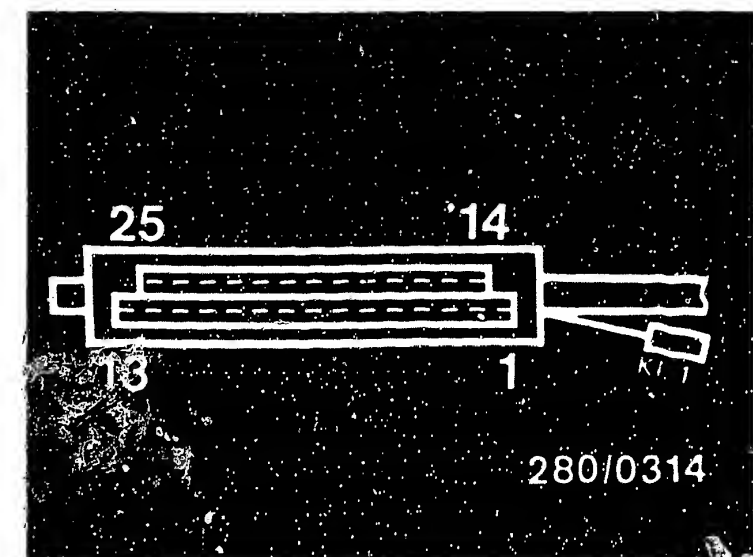
- From control-unit plug term. 12 to throttle-valve switch term. 3
- From throttle-valve switch term. 18 (lead 48) to electronics ground terminal.

Eliminate contact resistances in the plug-in connections.

- Spring contacts must not allow themselves to be pushed back.

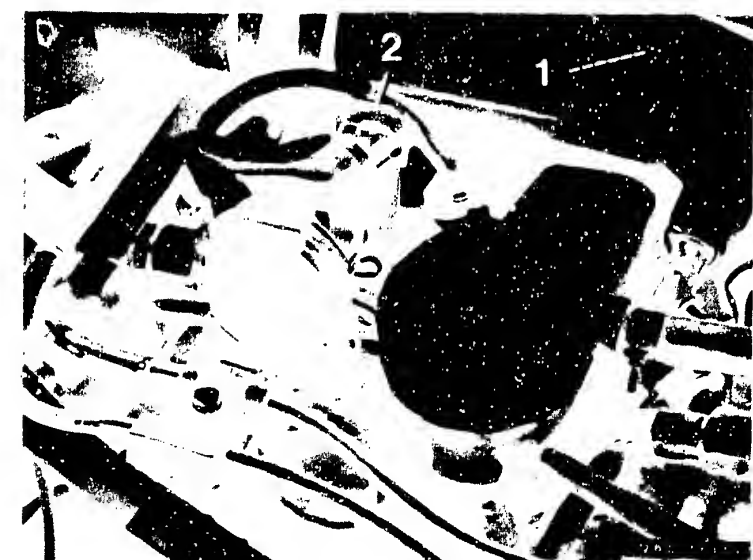
#### Installation position of components

Electronics ground terminal: Under rear pressure damper, on left near engine firewall



Top view of control-unit plug

- 1 = Throttle-valve switch  
2 = Adapter plug for throttle-valve switch connecting lead (extension)



**C23**

Test chart for universal test adapter  
Porsche 928 S USA



**C24**

Test chart for universal test adapter  
Porsche 928 S USA





TEST STEP 7 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of periphery
Program switch "V" in setting	↓	The tester must read 20.0... 32 $\Omega$ at ambient temperature (+15°C...+30°C): 24.5...37.0 $\Omega$ with engine at normal operating temperature (+80°C).	Component: Idle actuator (coil between Term. 1 and Term. 2).
Program switch "Ω" in setting	11		
Test equipment: Motortester or multimeter			Operation: Resistance on the control unit plug Term. 10 to ground.
Scale: x 1 $\Omega$		<div>Yes</div> <div>Continue test- ing with next test step</div> <div>No</div>	Malfunction Resistance not within tolerance
Connection: Blue test sockets			
Operation in vehicle: -----			

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

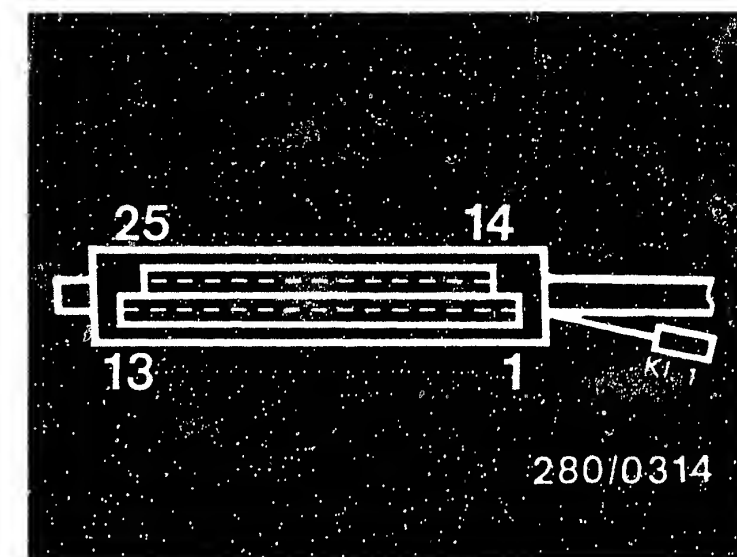
Check the following leads for continuity using an ohmmeter  
(Specified value approx. 0  $\Omega$ ):

- From control-unit plug term. 10 to idle actuator term. 1.
- From idle actuator term. 2 to pump relay term. 87.
- Resistance measurement at idle actuator between term. 1 and term. 2.  
At ambient temperature (+15°C...+30°C): 19.0...25.0  $\Omega$

Eliminate contact resistances in the plug connections.  
It must not be possible to shove the spring contacts back.

#### Installation position of the components

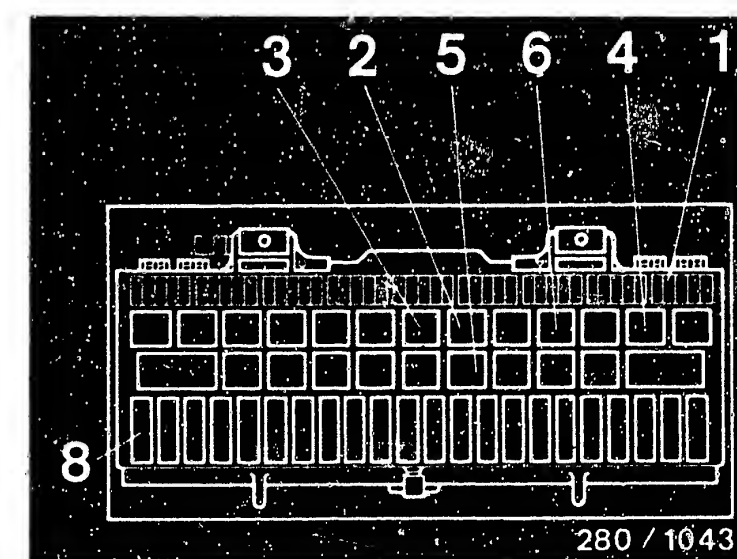
Idle actuator: In center of engine compartment, under intake manifold, to right of hot-wire air-mass sensor



Top view of control unit plug

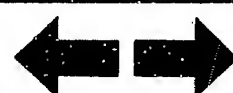
#### Central-electrics box

- 1 = Pump fuse
- 2 = Pump relay
- 8 = Central-electrics box plug



**D1**


Test chart for universal test adapter  
Porsche 928 S USA

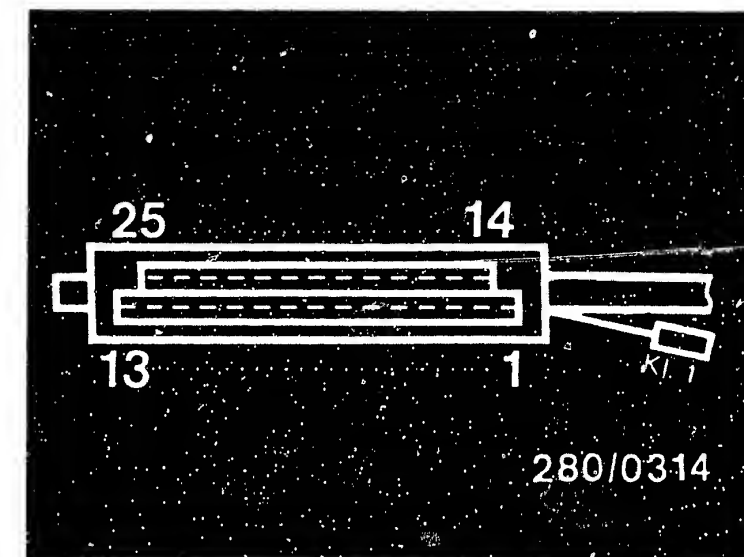


**D2**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 8 Connect adapter lead to peripherals <u>only</u> .			
<u>Operation</u>		<u>Reading</u>	<u>Testing of periphery</u>
<u>Program switch "V" in setting</u>		The tester must read <u>18 ... 29.5 Ω</u> at ambient temperature (+15°C...+30°C): <u>22...34.5Ω</u> with engine at normal operating temperature (+80°C).	<u>Component:</u> Idle actuator (coil between Term. 2 and Term. 3)
<u>Program switch "Q" in setting</u>			
<u>Test equipment:</u> Motortester or multimeter			
<u>Scale:</u> x 1 Ω			
<u>Connection:</u> Blue test sockets			
<u>Operation in vehicle:</u> -----			
		Yes Continue test- ing with <u>next</u> test step	
		No	<u>Malfunction</u> Resistance not within tolerance



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

Check the following leads for continuity using an ohmmeter  
(Specified value approx. 0  $\Omega$ ):

- From control-unit plug term. 23 to idle actuator term. 3.
- Resistance measurement at idle actuator between term. 2 and term. 3.  
At ambient temperature (+15°C...+30°C): 17... 22.5  $\Omega$

Eliminate contact resistances in the plug connections.  
It must not be possible to shove the spring contacts back.

#### Installation position of the components

Idle actuator: In center of engine compartment, under intake manifold, to right of hot-wire air-mass sensor

**D3**

Test chart for universal test adapter  
Porsche 928 S USA



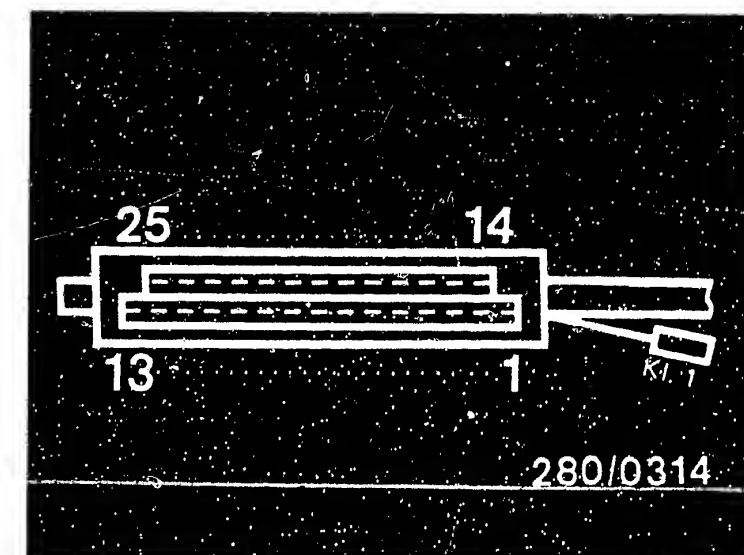
**D4**

Test chart for universal test adapter  
Porsche 928 S USA



# TEST STEP 9 Connect adapter lead to peripherals only.

Operation		Reading	Testing of peripherals
Program switch "V" at position:	↓	Measuring equipment must indicate $\infty \Omega$ .	Component: Jumper on control-unit plug
Program switch "Ω" at position:	14		
Measuring equipment: Motor-tester or multimeter			Operation: Data encoding Resistance at control-unit plug between term. 19 and term. 11
Measuring range: x 1 Ω			
Connection: Blue test sockets		yes Continue testing with next test step	Malfunction: Resistance not within tolerance
Operation in vehicle: -----		no ↓	



Top view of control-unit plug

## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Using ohmmeter, check the following leads for continuity:  
(Set value approx 0 Ω):

- From control-unit plug term. 19 (brown lead) to individual plug connector on control-unit plug.  
Individual plug connector must not be connected.

Eliminate contact resistances in the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.

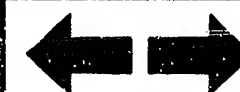
D5

Test chart for universal test adapter  
Porsche 928 S USA



D6

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 10 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	↓	Measuring equipment must indicate	Component:
Program switch "Ω" at position	21	150...600 Ω.	Potentiometer in hot-wire air-mass sensor
Measuring equipment: Motor-tester/multimeter			Operation:
Measuring range: x 10 Ω		Yes ↓ No ↓	Potentiometer for idle-mixture adjustment (term. 6 and term. 3 on hot-wire air-mass sensor)
Connection: Blue test sockets		Continue testing with next test step.	Malfunction:
Operation in vehicle: --			Resistance not within tolerance

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter

(Set value approx. 0 Ω):

- From control-unit plug term. 14 to hot-wire air-mass sensor term. 6.
- From hot-wire air-mass sensor term. 3 to control-unit plug term. 6.

Measure resistance directly at hot-wire air-mass sensor between term. 6 and term. 3. Set value 150...600 Ω.

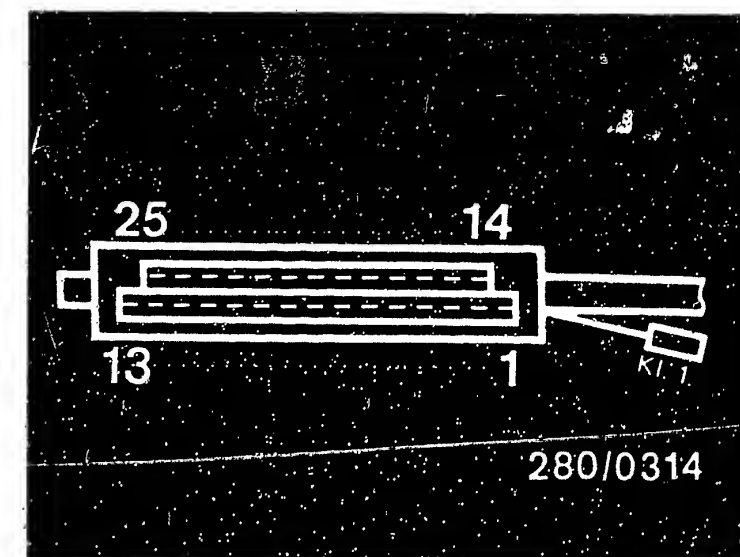
Set resistance to 370...390 Ω. Using suitable tools, drill out lead seal on mixture-adjusting screw. After adjusting, a new aluminum plug must be pressed in (part no. 1 283 123 004).

If not adjustable, replace hot-wire air-mass sensor.

If adjustable, CO adjustment must be checked.

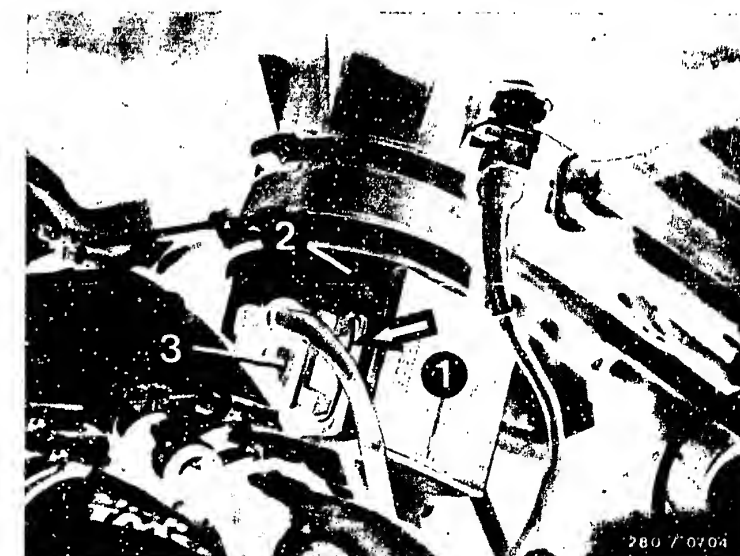
Eliminate contact resistances in the plug-in connections.

Spring contacts must not allow themselves to be pushed back.



Top view of control-unit plug

- 1 = Hot-wire air-mass sensor
  - 2 = Potentiometer for idle-mixture adjustment
  - 3 = Plug
- When disconnecting plug, press retainer in direction of arrow)



**D7**

Test chart for universal test adapter  
Porsche 928 S USA



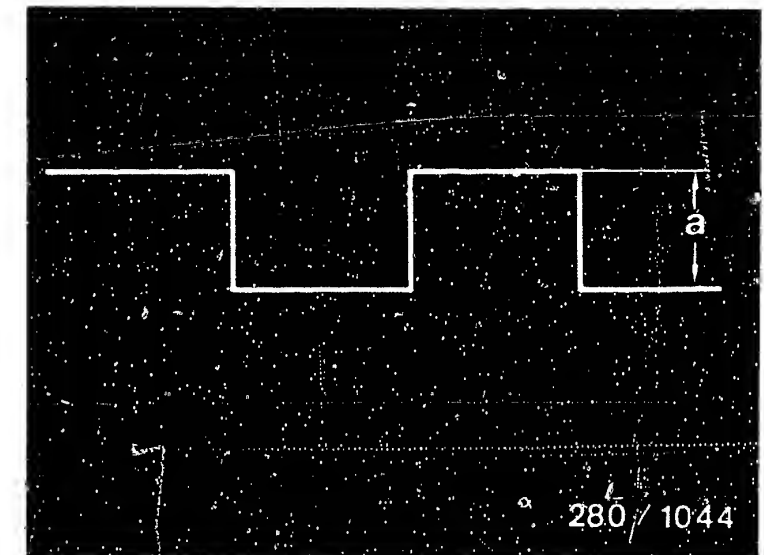
**D8**

Test chart for universal test adapter  
Porsche 928 S USA



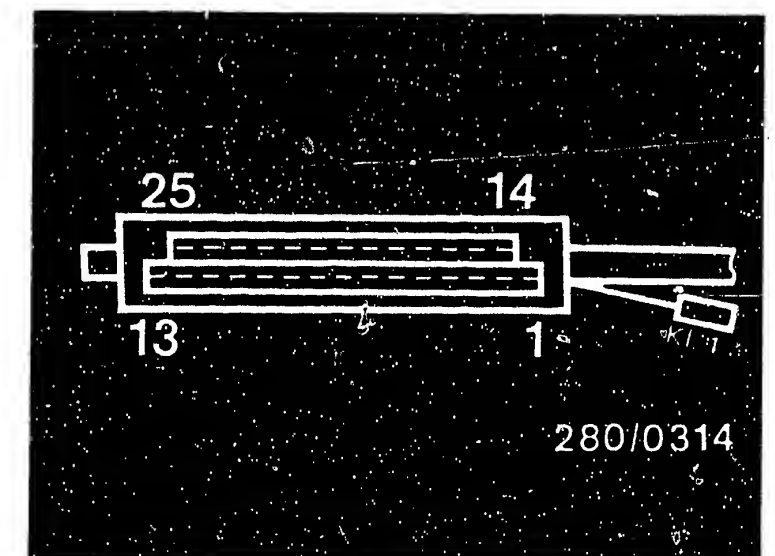
# TEST STEP 11 Connect adapter lead to peripherals only.

<u>Operation</u>		<u>Reading</u>	<u>Testing of peripherals</u>
<u>Program switch "V"</u> <u>at position</u>	5	$t_n$ signal present (See top diagram)	<u>Component:</u> Ignition coils, ignition cables, ignition trigger boxes, electronic ignition control unit
<u>Program switch "Ω"</u> <u>at position</u>	21		
<u>Measuring equipment:</u> Motor-tester with oscilloscope			
<u>Measuring range:</u> Special input Setting % and 10 V (if present)		<div><div>Yes</div><div>Continue testing with <u>next test step</u></div></div> <div>No</div>	<u>Operation:</u> $t_n$ signal from electronic ignition control unit term. 16 to LH control unit term. 1
<u>Connection:</u> Test wells. Red clip to red well, black clip to black well. Clamp-on trigger pickup to cylinder 1.			
<u>Operation in vehicle:</u> Ignition "ON". Shift gear to neutral and start.			<u>Malfunction:</u> No signal or signal incorrect



$t_n$  signal  
 $a = \text{approx. } 10.0 \dots 11.0 \text{ V}$

Top view of control-unit plug



## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Continued on D11/D12

**D9**

Test chart for universal test adapter  
 Porsche 928 S USA



**D10**

Test chart for universal test adapter  
 Porsche 928 S USA

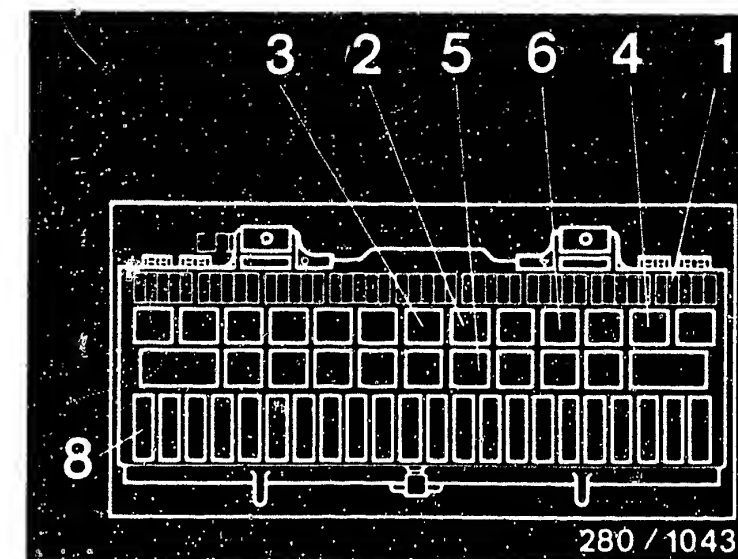




### Trouble-shooting - test step 11 (continued)

- From control-unit plug term. 1 to electronic ignition control unit term. 16.
- From electronic ignition control-unit plug term. 16 to central-electrics box plug W term. no. 11.
- From central-electrics box plug W term. no. 11 to kick-down relay (5) term. 31b.
- From central-electrics box plug W term. no. 11 to central-electrics box plug J term. no. 11 and on to tachometer.

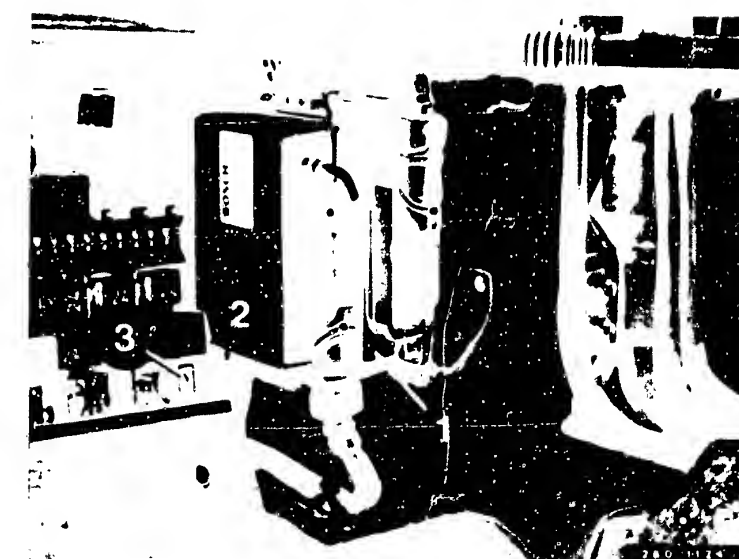
If fault still present: Clamp trigger pickup onto a different cylinder.  
Eliminate contact resistances in the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.  
If fault cannot be found: Check electronic ignition system.



### Central-electrics box plug

5 = Kick-down relay  
8 = Central-electrics box plug

1 = LH control unit  
2 = EZ control unit



**D 11**

Test chart for universal test adapter  
Porsche 928 S USA



**D 12**

Test chart for universal test adapter  
Porsche 928 S USA





TEST STEP 12 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	6	Measuring equipment must indicate  8...15 V.	Component: Main relay, power supply
Program switch "Ω" at position	21		
Measuring equipment: Motor-tester/multimeter			
Measuring range: 15 V			Operation: Power supply from main relay term. 87
Connection: Red test socket/well = pos. Black test socket/well = ground		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">             Yes ↓ Continue testing with next test step.           </div> <div style="text-align: center;">             No ↓           </div> </div>	Malfunction: No voltage reading
Operation in vehicle: Ignition "ON"			
Press button 4			

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter

(Set value: approx. 0 Ω):

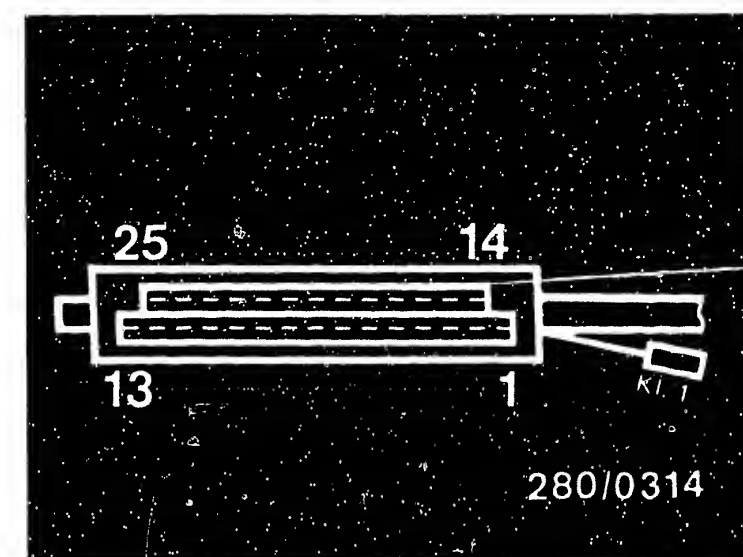
- From control-unit plug term. 9 to central-electrics box plug W term. no. 23.
- From central-electrics box plug W term. no.23 to main relay (4) term. 87.
- From main relay term. 30 to pump relay (6) term. 30.
- From pump relay (6) term. 30 to central-electrics box plug U term. no. 12.
- From central-electrics box plug U term. no.12 to positive battery terminal (disconnect battery).

#### All vehicles:

If leads O.K. but test specification not obtained: Replace main relay.

After testing, connect battery.

Eliminate contact resistances at the plug-in connections. Spring contacts must not allow themselves to be pushed back.



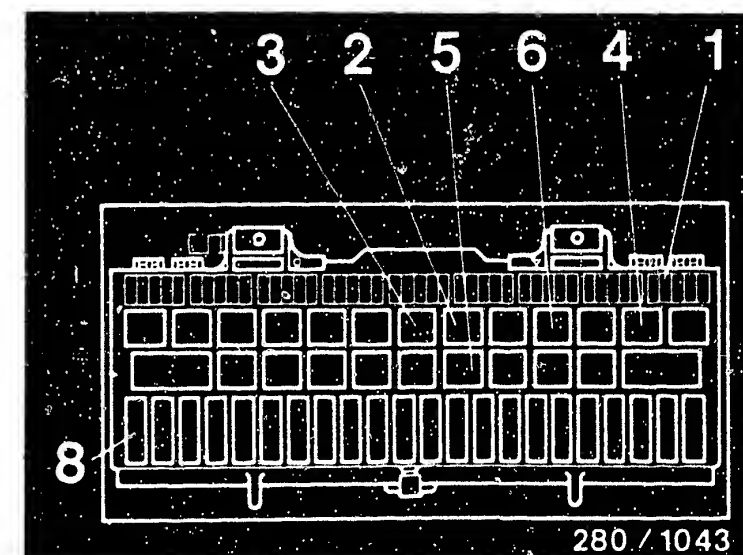
Top view of control-unit plug

#### Central-electrics box

4 = Main relay

6 = Pump relay

8 = Central-electrics box plug



**D 13**

Test chart for universal test adapter

Porsche 928 S USA



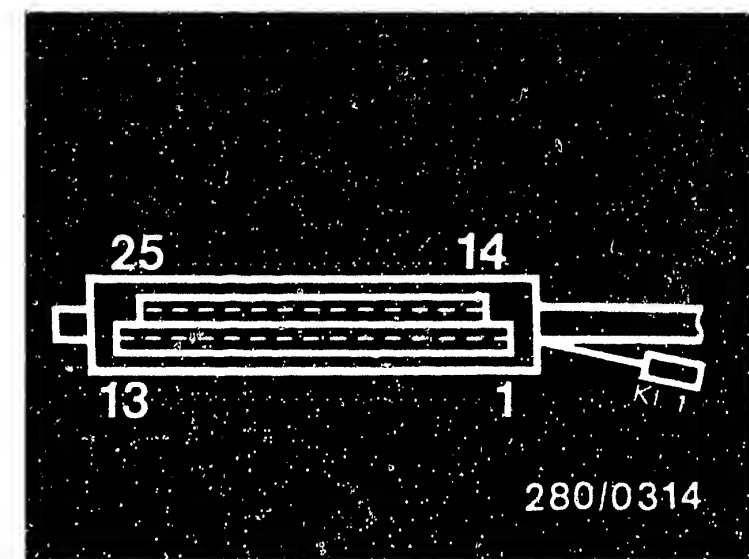
**D 14**

Test chart for universal test adapter

Porsche 928 S USA

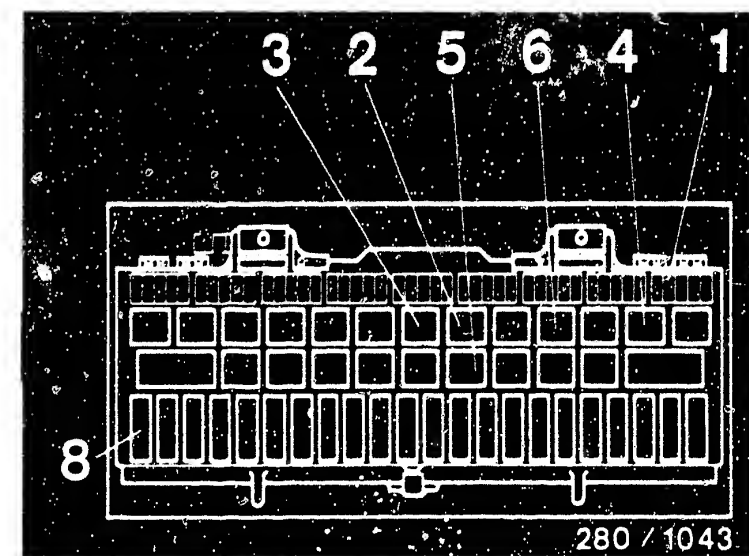


TEST STEP 13 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	7	Measuring equipment must indicate 8...15 V.	Component: Power supply relay
Program switch "Ω" at position	21		
Measuring equipment: Motor-tester/multimeter			Operation: Power supply of control-unit plug term. 18
Measuring range: 15 V			
Connection: Red test socket/well = pos. Black test socket/well = ground			
Operation in vehicle: Ignition "ON"		Yes Continue testing with next test step.	Malfunction: No power supply
		No	



Top view of control-unit plug

Central-electrics box  
 2 = Power supply relay  
 8 = Central-electrics box plug




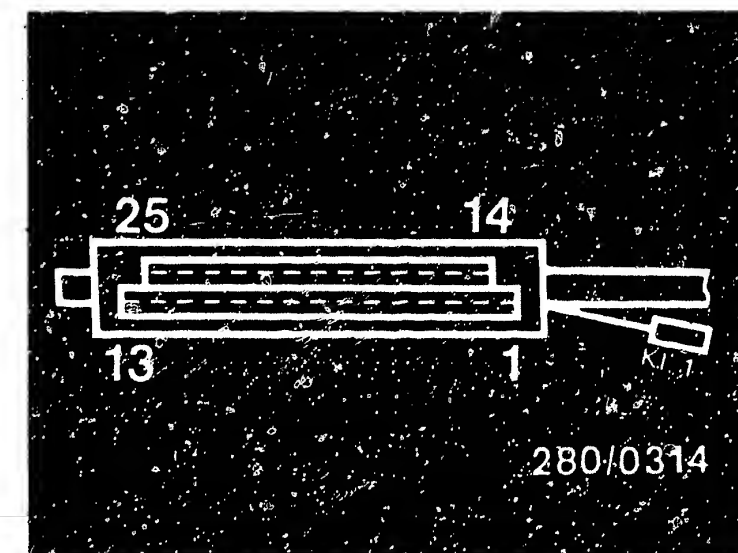
Trouble-shooting:  
 For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessar.

Check the following leads for continuity with ohmmeter  
 (Set value: approx. 0 Ω):

- From control-unit plug term. 18 to central-electrics box plug W term. no. 14.
- From central-electrics box plug W term. no. 14 to power-supply relay (2) term. 87.
- From power-supply relay (2) term. 30 to central-electrics box plug U term. no. 11.
- From central-electrics box plug U term. no. 11 to positive terminal of battery (disconnect battery for measuring).
- From power-supply relay term. 85 to ground.
- From power-supply relay term. 86 to central-electrics box plug F term. no. 25.
- From central-electrics box plug F term. no. 25 through jumper for alarm system (standard production) to central-electrics box plug B term. no. 23 and on to term. 15.

All vehicles:  
 Eliminate contact resistances at the plug-in connections.  
 Spring contacts must not allow themselves to be pushed back.  
 After testing, re-connect battery.

TEST STEP 14 Connect adapter lead to peripherals <u>only</u> .			
Operation		Reading	Testing of peripherals
Program switch "V" at position	8	Measuring equipment must indicate <div style="text-align: center;">  </div>	Component: Main relay
Program switch "Ω" at position	21		
Measuring equipment: Motor-tester/multimeter			Operation: Main relay winding and ground connection term. 21
Connection: Red test socket/well = pos. Black test socket/well = ground		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">           Yes ↓ Continue test- ing with next test step.         </div> <div style="text-align: center;">           No ↓         </div> </div>	Malfunction: No voltage reading
Operation in vehicle: Ignition "ON"			



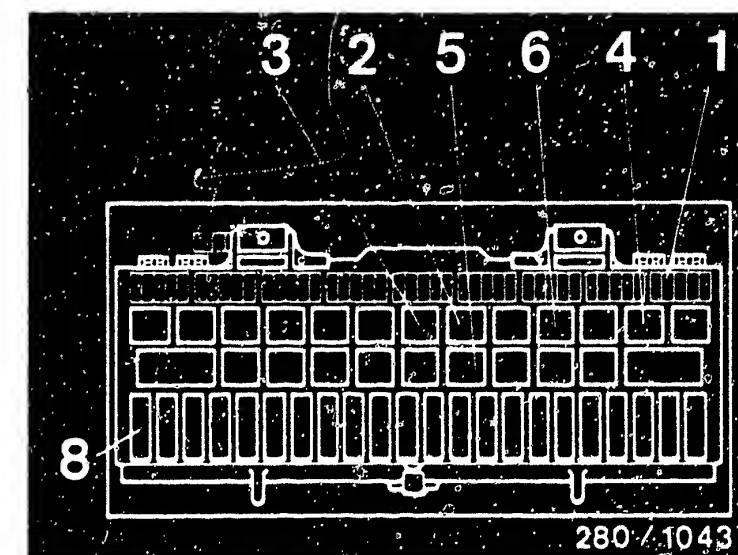
Top view of control-unit plug

#### Central-electrics box

3 = Starting relay

4 = Main relay

8 = Central-electrics box plug



#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter  
(Set value approx. 0 Ω):

#### Up to 9.84:

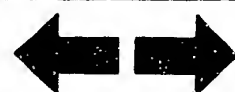
- From control-unit plug term. 21 to central-electrics box plug W term. no. 21.
- From central-electrics box plug W term. no. 21 to main relay (4) term. 85.
- From main relay (4) term. 86 to starting relay (3) term. 30.
- From starting relay (3) term. 30 to bar term. 30.

#### All vehicles:

Eliminate contact resistances at the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.  
After testing, re-connect battery.

**D17**


Test chart for universal test adapter  
Porsche 928 S USA

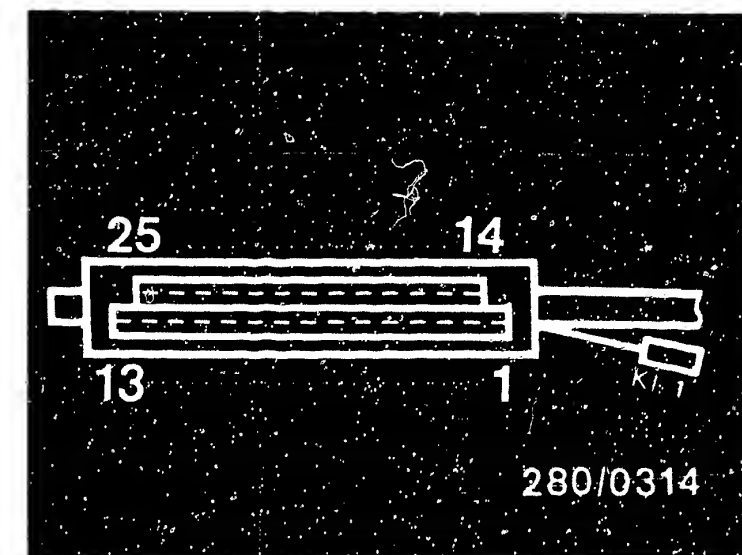


**D18**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 15 Connect adapter lead to control unit and peripherals.			
Operation		Reading	Testing of peripherals
Program switch "V" at position	9	Measuring equipment must indicate <div style="text-align: center;">  </div>	Component: Pump relay
Program switch "Ω" at position	21		
Measuring equipment: Motor-tester/multimeter			Operation: Pump relay winding and ground connection term. 17
Measuring range: 15 V		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">           Yes ↓         </div> <div style="text-align: center;">           No ↓         </div> </div>	
Connection: Red test socket/well=pos. Black test socket/well=ground			Malfunction: No voltage reading
Operation in vehicle: Ignition "ON"			
		Continue testing with next test step.	



Top view of control-unit plug

#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter  
(Set value: approx. 0 Ω):

- From control-unit plug term. 17 to central-electrics box plug W term.no. 15.
- From central-electrics box plug W term.no. 15 to pump relay (6) term. 85.
- From pump relay (6) term. 86 through term. 15 to central-electrics box plug Q term.no. 11 and 12.
- From central-electrics box plug Q term.no. 11/12 to both ignition coils term. 15.
- If leads O.K.: Replace pump relay.  
Eliminate contact resistances at the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.

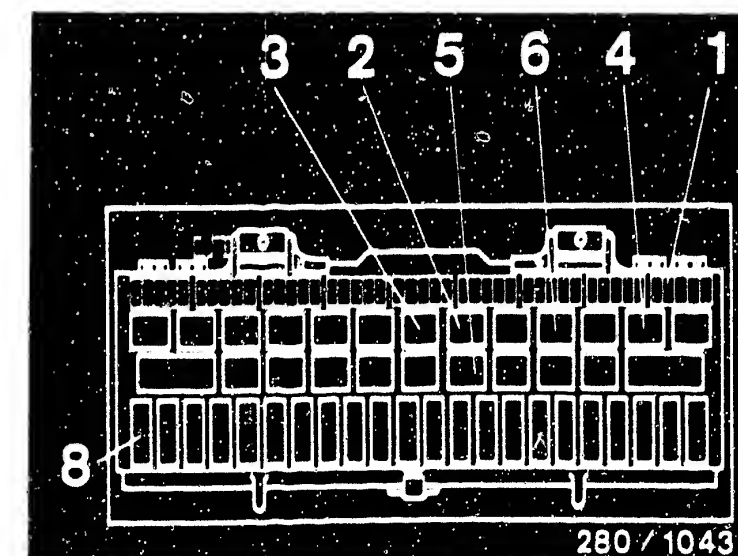
#### Installation position of components:

Ignition coils: In engine compartment, on left and right of the inner fenders.

#### Central-electrics box

6 = Pump relay

8 = Central-electrics box plug



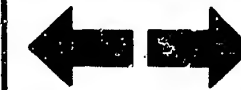
**D19**

Test chart for universal test adapter  
Porsche 928 S USA

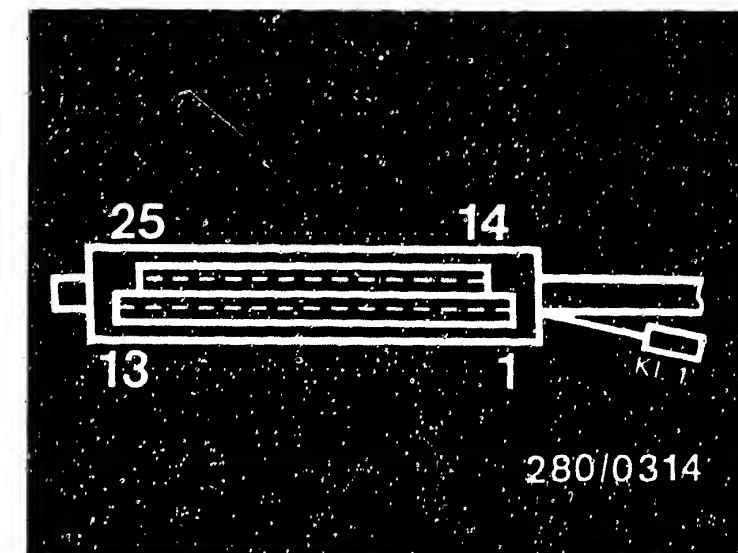


**D20**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 16 (Not used for vehicles without air conditioner) Ignition "OFF". Connect adapter lead to control unit and periphery!					
Operation		Reading		Testing of periphery	
Program switch "V" in setting	10	Tester must read 8 ... 15 V		Component: Air conditioner switch	
Program switch "Ω" in setting	21				
Test equipment: Motortester or multimeter		Yes ↓ Continue testing with next test step	No ↓	Operation: Voltage signal at control unit Term. 16	
Scale: 15 V				Malfunction: No reading for voltage	
Connection: Test socket/well red → positive Test socket/well black → ground					
Operation in vehicle: Ignition "ON". Have engine run. Switch air conditioner on (Button AC, air distribution windshield)					



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

Check the following leads for continuity using an ohmmeter  
(Specified value approx. 0 Ω):

- From control-unit plug term. 16 to central-electrics box plug W term.no.24.
  - From central-electrics box plug W term.no. 24 to central-electrics box plug M term.no. 12 and K term.no. 21.
- From these terminals on to the magnetic clutch low-pressure switch, evaporator thermo-switch, anti-icing.

Eliminate contact resistances in the plug connection.

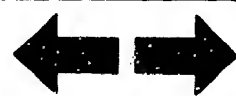
It must not be possible to shove spring contacts back.

Installation position of the components

Air conditioner: Air conditioner switch at the center of the dashboard.

**D21**

Test chart for universal test adapter  
Porsche 928 S USA



**D22**

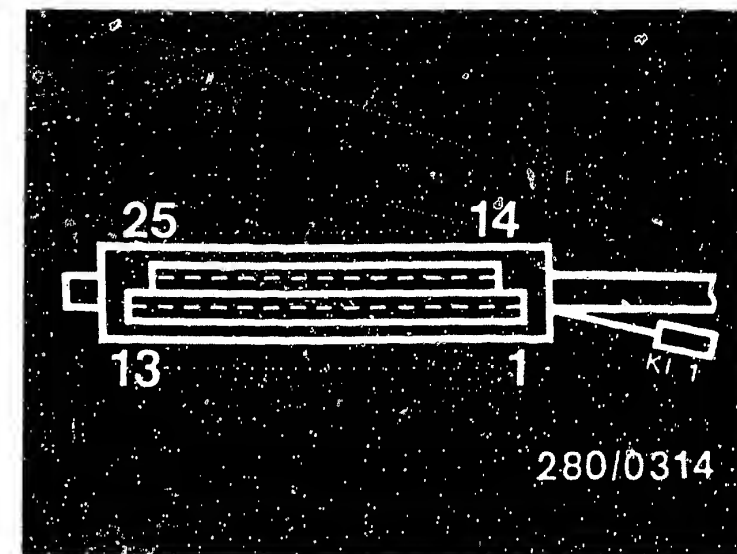
Test chart for universal test adapter  
Porsche 928 S USA





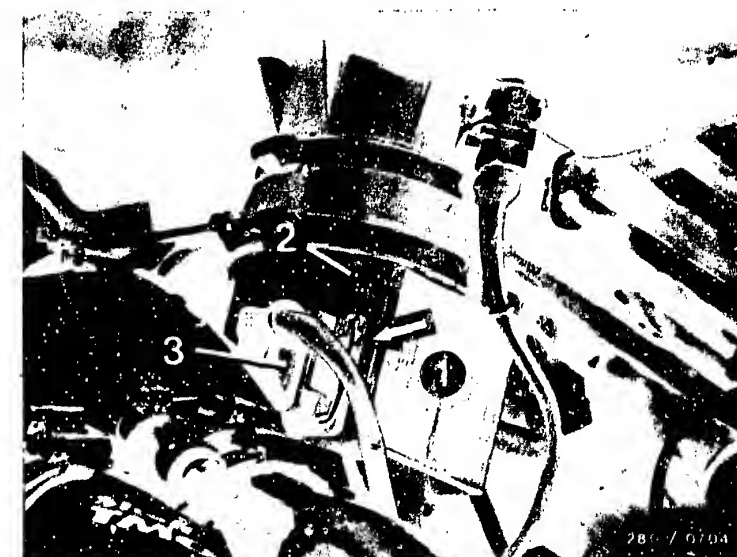
# TEST STEP 17 Connect adapter lead to control unit and peripherals.

Operation		Reading	Testing of peripherals
Program switch "V" at position	3	Measuring equipment must indicate 2...5 V.	Component: Hot-wire air-mass sensor
Program switch "Ω" at position	21		
Measuring equipment: Motor-tester/multimeter			
Measuring range: 10 V			
Connection: Red test socket/well = pos. Black test socket/well = ground			Operation: Output voltage between term. 7 and term. 6
Operation in vehicle: Let engine run. If engine speed changes, output voltage must also change.		<div>Yes</div> <div>Continue testing with next test step.</div>	<div>No</div> <div>Malfunction: No voltage reading No voltage change</div>



Top view of control-unit plug

1 = Hot-wire air-mass sensor  
3 = Plug



## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter  
(Set value: approx. 0 Ω):

- From control-unit plug term. 7 to hot-wire air-mass sensor term. 5.
- From hot-wire air-mass sensor term. 3 to control-unit plug term. 6.
- From hot-wire air-mass sensor term. 4 to electronics ground terminal.  
(under rear pressure damper, on left near engine firewall).

Continued on E1/E2

D23

Test chart for universal test adapter  
Porsche 928 S USA



D24

Test chart for universal test adapter  
Porsche 928 S USA





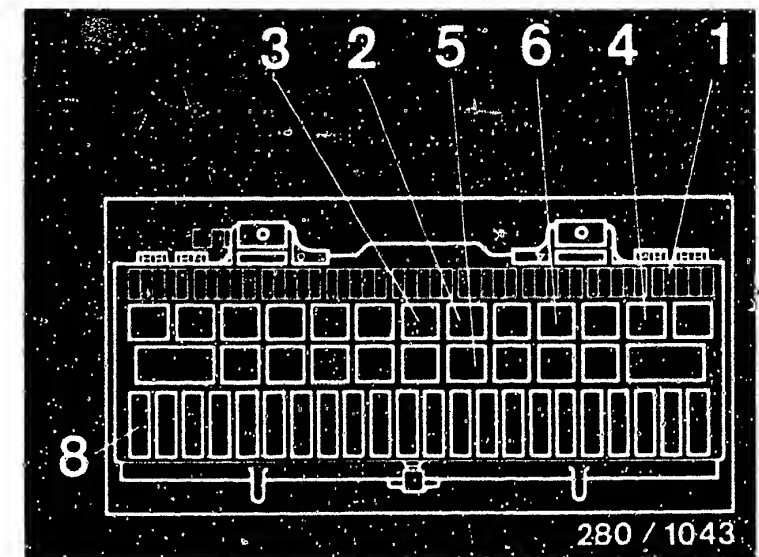
### Trouble-shooting - test step 17 (continued)

- From hot-wire air-mass sensor term. 2 to central-electrics box plug W term. no. 23.
- From central-electrics box plug W term. no. 23 to main relay term. 87.

Note: When engine speed changes, there must also be a change in the output voltage.  
Eliminate contact resistances at the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.

### Installation position of components

Electronics ground terminal: under rear pressure damper, on left near engine firewall.



Central-electrics box  
4 = Main relay

**E1**

Test chart for universal test adapter  
Porsche 928 S USA



**E2**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 18 Connect adapter lead to control unit and periphery!			
Operation		Reading	Testing of control unit
Program switch "V" in setting	11	Tester must read <u>10...13 V</u>	Component: Control unit
Program switch "Ω" in setting	21*		
Test equipment: Motortester or multimeter		<div>Yes</div> <div>No</div> <div>Continue testing with next test step</div>	Operation: Lambda closed-loop control, open-loop control value Term. 22
Scale: 5 V			Malfunction: Value for voltage not within tolerance
Connection: Test socket/well red → positive Test socket/well black → ground			
Operation in vehicle: Have the engine run at normal operating temperature			

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

Check the following leads for continuity with an ohmmeter (Specified value approx. 0 Ω):

- From control-unit plug term. 22 to test socket term. A
- From test socket C to electronics ground terminal.

Eliminate contact resistances in the plug connections.

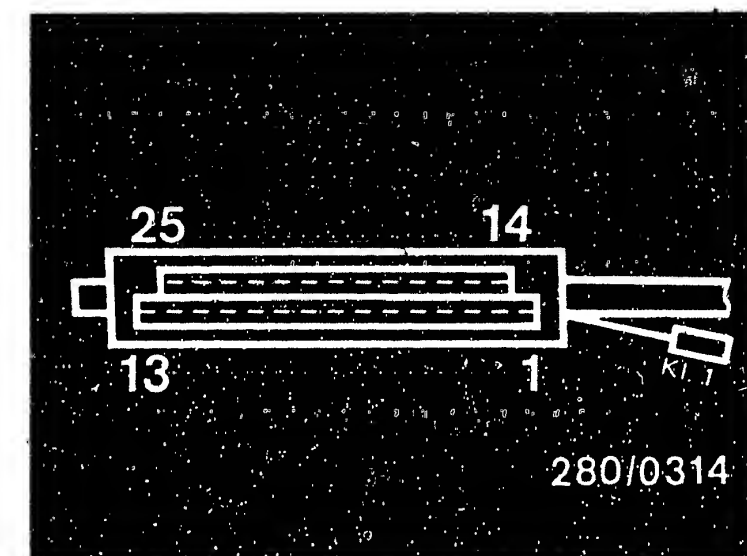
It must not be possible to shove spring contacts back.

If no defect can be found and the reading is nevertheless incorrect, take out and replace the control unit.

\* Settings 22, 23, and 24 for the Ω switch are not allowed!

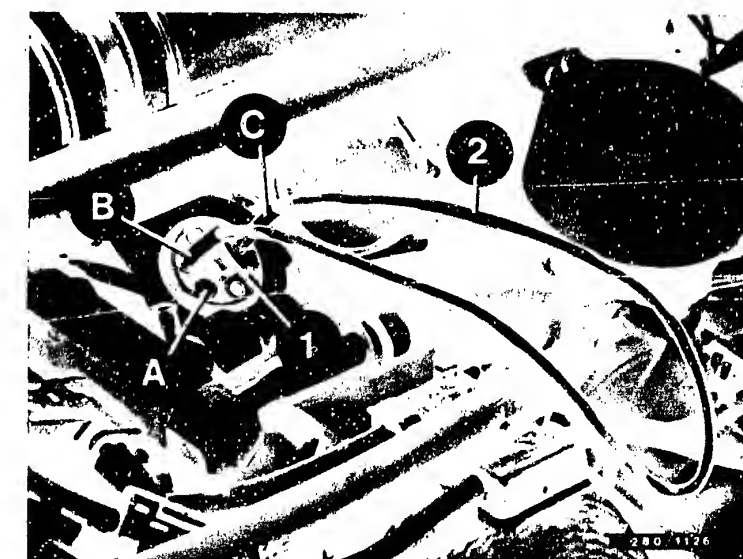
#### Installation position of components

Electronics ground terminal: under rear pressure damper, on left near engine firewall.



Top view of control unit plug

- 1 = Test socket
- 2 = Auxiliary lead
- A = Test output of lambda closed-loop control integrator
- C = Ground test output



E3

Test chart for universal test adapter  
Porsche 928 S USA

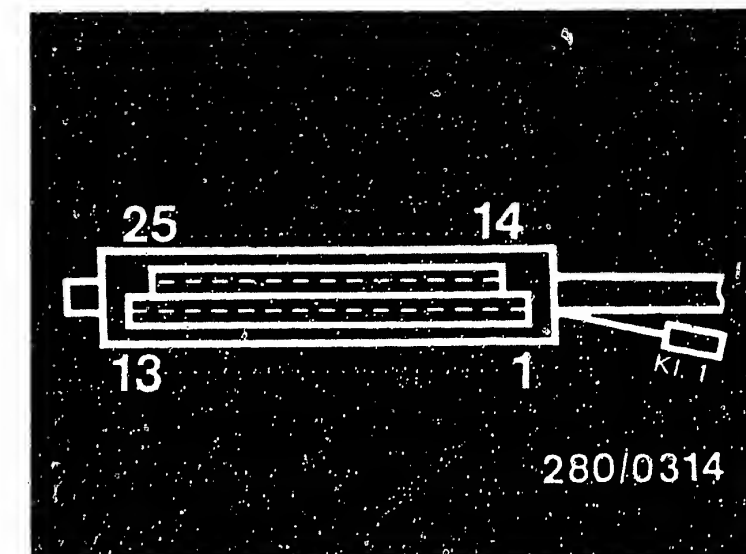


E4

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 19     Connect adapter lead to control unit and periphery!			
<u>Operation</u>		<u>Reading</u>	<u>Testing of control unit</u>
<u>Program switch "V" in setting</u>	11	Tester must read <u>10 ... 13 V</u> (Wait for steady reading.)	<u>Component:</u> Control unit
<u>Program switch "Ω" in setting</u>	22		
<u>Test equipment:</u> Motortester or multimeter		<div>Yes</div> <div>No</div>	<u>Operation:</u> Lambda closed-loop control, rich value Term. 22
<u>Scale:</u>	15 V		
<u>Connection:</u> Test socket/well red → positive Test socket/well black → ground			
<u>Operation in vehicle:</u> Have the engine run at normal operating temperature			
		Continue testing with <u>next test step</u>	<u>Malfunction:</u> Reading for voltage not within tolerance



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

If no defect can be found, and the reading is nevertheless incorrect, take out and replace the control unit.

**E5**

Test chart for universal test adapter  
Porsche 928 S USA

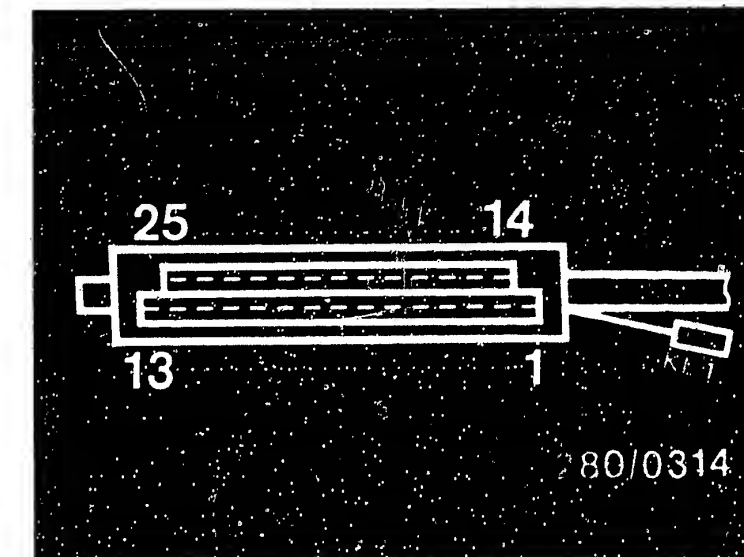


**E6**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 20    Connect adapter lead to control unit and periphery!			
<u>Operation</u>		<u>Reading</u>	<u>Testing of control unit</u>
<u>Program switch "V" in setting</u>	11	Tester must read <u>less than 0.5 V</u>  (Reading is obtained after approx. 10 sec)	<u>Component:</u> Control unit
<u>Program switch "Ω" in setting</u>	23		
<u>Test equipment:</u> Motortester or multimeter		<div>Yes</div> <div>↓</div> <div>Continue testing with next test step</div> <div>No</div> <div>↓</div>	<u>Operation:</u> Lambda closed-loop control Lean value, Term. 22
<u>Scale:</u> 15 V			
<u>Connection:</u> Test socket/well red → positive Test socket/well black → ground			
<u>Operation in vehicle:</u> Have the engine run at normal operating temperature			
			<u>Malfunction:</u> Reading for voltage greater than tolerances indicated



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

Voltage must be cut back slowly (after no later than approx. 10 sec) to the setpoint value.

If no defect can be found and the reading is nevertheless incorrect, take out and replace the control unit.

**E7**

Test chart for universal test adapter  
Porsche 928 S USA



**E8**

Test chart for universal test adapter  
Porsche 928 S USA



# TEST STEP 21 Connect adapter lead to control unit and periphery!

Operation		Reading		Testing of control unit	
<u>Program switch "V" in setting</u>	11	Tester must read <u>0 ... 13 V</u> (alternating)		Component: <u>Control unit</u>	
<u>Program switch "Ω" in setting</u>	24				
<u>Test equipment:</u> Motortester or multimeter		<div>Yes</div> <div>Continue testing with next test step</div>	<div>No</div>	<u>Operation:</u> Lambda closed-loop control Closed-loop control value Term. 22	
<u>Scale:</u> 15 V					
<u>Connection:</u> Test socket/well red → positive Test socket/well black → ground					
<u>Operation in vehicle:</u> Have the engine run at normal operating temperature					
				<u>Malfunction:</u> Voltage constant or not within tolerance	

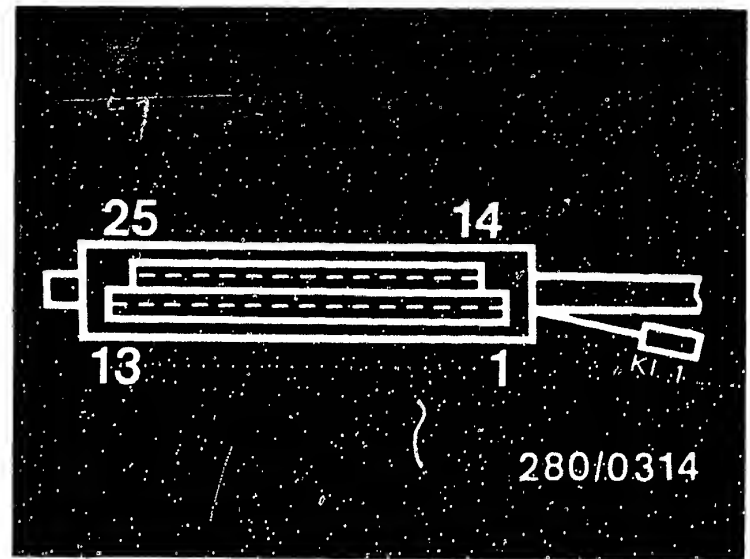
## Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

The reading must fluctuate back and forth between the lean value of approx. 0 V and rich value of up to approx. 13 V. (The engine and the sensor must be hot!)

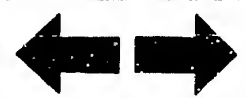
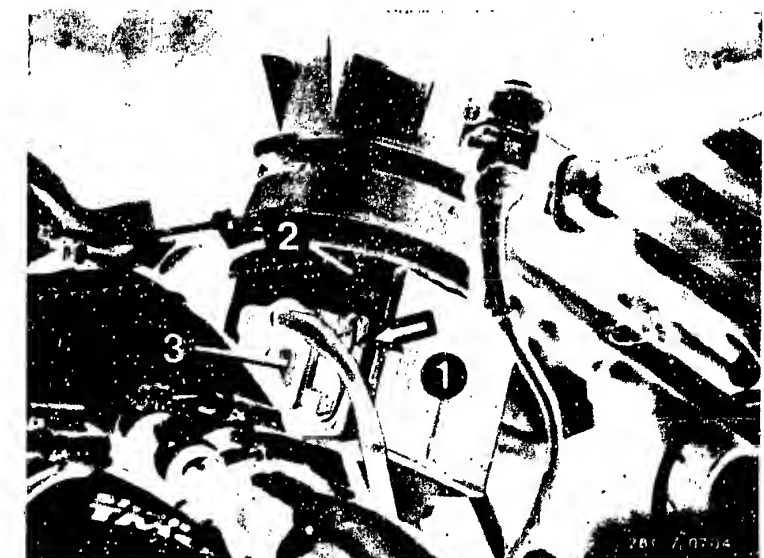
If the reading remains constant or not within tolerance: CO adjustment.

Continued on E11/E12



Top view of control unit plug

- 1 = Hot-wire air-mass sensor
  - 2 = Potentiometer for idle-mixture adjustment
  - 3 = Plug
- When disconnecting plug, press retainer in direction of arrow)





## Trouble-shooting - test step 21 (continued)

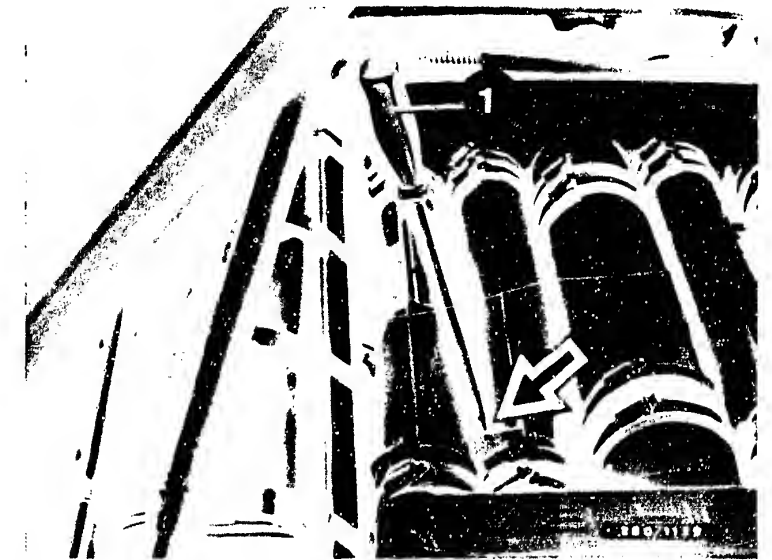
### CO adjustment (Integrator voltage):

The CO concentration in the exhaust gas is set indirectly through the integrator voltage of the lambda closed-loop control.

When making the adjustment at the potentiometer mixture-adjusting screw on the hot-wire air-mass sensor, it is necessary to drill out the anti-tamper device (use suitable commercially available tools) and, after testing, it is absolutely necessary to insert a new lead seal (1 283 123 004). The adjustment must be made in small steps (hexagon-socket-head cap screw A/F 3 and jointed screwdriver no. 9230 from Porsche). Then it is always necessary to check the voltage reading.

No adjustment possible?

Continued on E13/E14



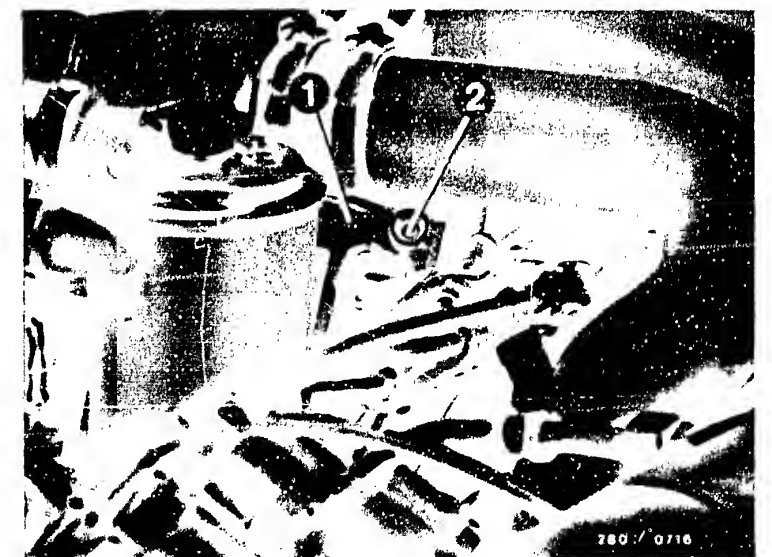
Arrow=Potentiometer for idle mixture adjustment

1 = Jointed screwdriver

similar to 928 S US 16-valve

1 = Hot-wire air-mass sensor

2 = Mixture-adjusting screw



**E11**

Test chart for universal test adapter  
Porsche 928 S USA



**E12**

Test chart for universal test adapter  
Porsche 928 S USA





## Trouble-shooting - Test step 21 (continued)

Sensor properly pre-heated?

Run engine at 3000 min<sup>-1</sup> for 30 sec. Idle, voltage now fluctuates.

- If not, ignition "OFF". Sensor lead not correctly connected at connection point, contact resistances? Check and, if necessary, repair.  
Does idle voltage now fluctuate? If not, ignition "OFF", take apart sensor plug connector. Check the following leads for continuity:

- From control-unit plug term. 20 to electronics ground terminal. Set value  $\infty\Omega$ .

- Connect to ground lead from control unit term. 20 at connection point.  
Set value approx. 0  $\Omega$ .  
If not, replace lead.

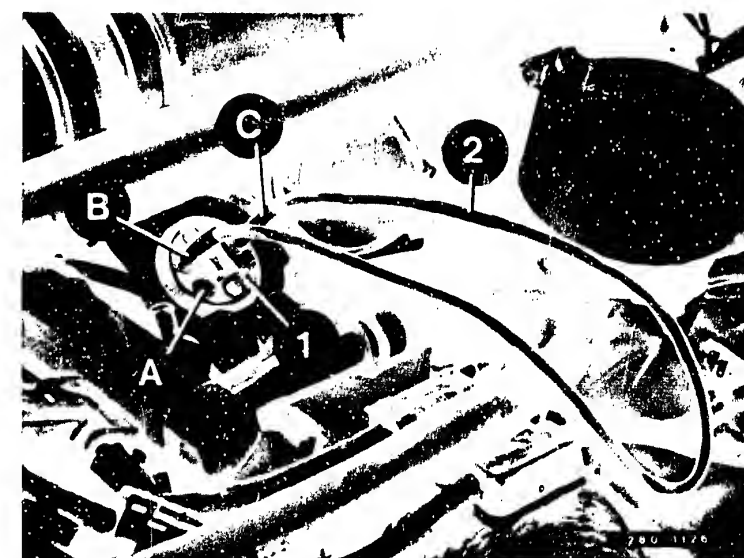
Caution: Sensor lead must be shielded.

The Lambda sensor must not be tested directly with a multimeter. Measuring current may destroy lambda sensor. Plug together plug connector. Let engine run (3000 min<sup>-1</sup> for 30 sec). Does idle voltage now fluctuate? If not, ignition "OFF". Check the following leads for continuity:

- From control-unit plug term. 22 to test socket term. A. Set value approx. 0  $\Omega$   
If not, replace lead.  
Idle, does voltage now fluctuate? If not -
- Lambda sensor defective. When mounting a new sensor, use grease VS 140 16 Ft.
- LH control unit defective.



- 2 = Sensor plug connector
- 3 = Sensor heating connection point
- 1 = Test socket
- 2 = Test lead (user-fabricated)
- A = Test output of lambda closed-loop control integrator voltage
- B = Test output of idle-speed control
- C = Ground test output



**E13**

Test chart for universal test adapter  
Porsche 928 S USA



**E14**

Test chart for universal test adapter  
Porsche 928 S USA

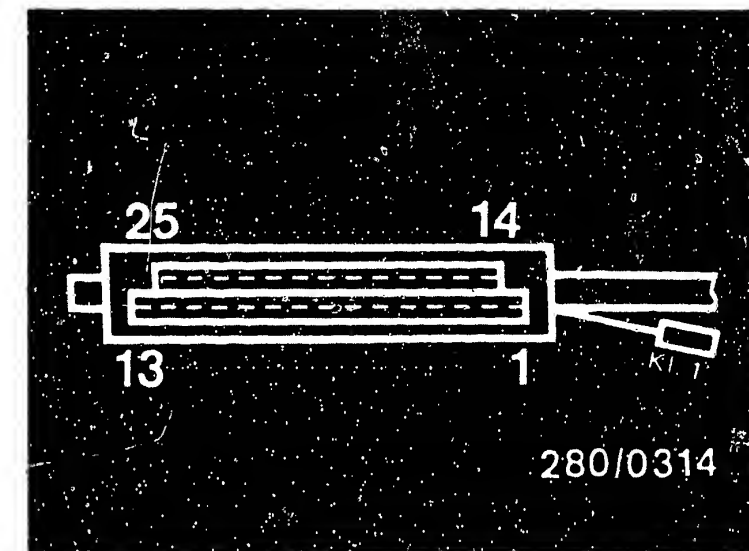


TEST STEP 22   Connect adapter lead to control unit and periphery!			
Operation		Reading	Testing of control unit
<u>Program switch "V" in setting</u>	11	Tester must read <u>660 ... 700 min<sup>-1</sup></u>	Component: <u>Control unit</u>
<u>Program switch "Ω" in setting</u>	24		
<u>Test equipment:</u> Motortester or multimeter Pocket-Tester		<div>Yes</div> <div>↓</div> <div>Continue testing with next test step</div> <div>No</div>	<u>Operation:</u> Basic idle setting
<u>Scale:</u> Engine speed range			<u>Malfunction:</u> Engine speed not within tolerance
<u>Connection:</u> Ignition coil Term.15 & Term.1			
<u>Operation in vehicle:</u> Have the engine run at normal operating temperature.			
<u>On test socket:</u> Connect test outputs B with C (auxiliary lead).			

#### Trouble-shooting:

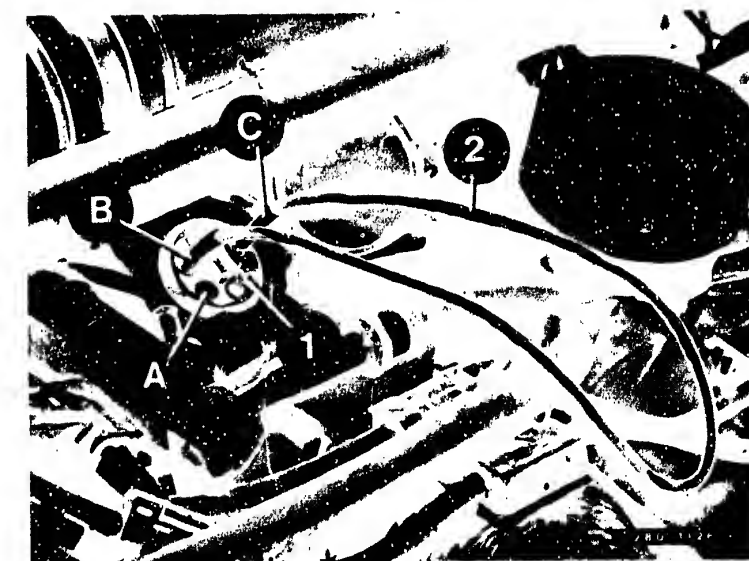
To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram. (Switch off electrical devices).

- Ensure good connection. Set engine speed to  $660 \dots 700 \text{ min}^{-1}$  with idle-speed adjusting screw.
- Engine speed cannot be adjusted +
- Check that there is a good ground connection for the test pin.
- Take out and replace the control unit.



Top view of control unit plug

- 1 = Test socket
- 2 = Auxiliary lead
- B = Test output of idle-speed control
- C = Test output



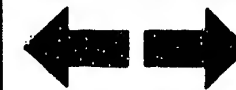
**E15**

Test chart for universal test adapter  
Porsche 928 S USA



**E16**

Test chart for universal test adapter  
Porsche 928 S USA



TEST STEP 23    Connect adapter lead to control unit and periphery!				
Operation		Reading		Testing of control unit
Program switch "V" in setting	11	Measuring equipment must indicate 31.5...34.0%		Component Control unit
Program switch "Ω" in setting	24	28 ... 30%	1)	
		42 ... 48.0%	2)	
Test equipment: Motortester or Pocket-Tester		must increase approx. 5%	3)	Operation: Triggering of the idle actuator Term. 9 and Term. 23
Scale: Dwell angle 100%		34.0...40.0%	4)	
Connection: Black test sockets No. 1 and 2		Yes	No	
Operation in vehicle: Run engine at normal operating temperature. Further information at *		Continue testing with next test step		Malfunction: On/off ratio is not within tolerance

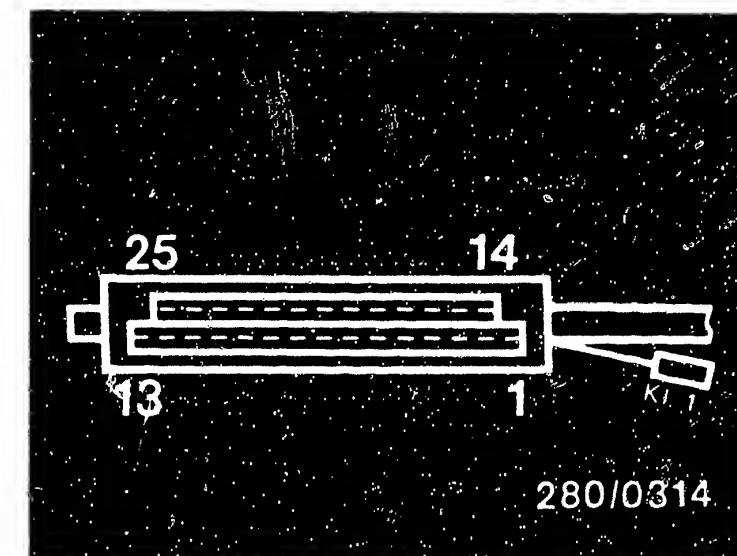
- \* 1) = Reading for: On test socket, test outputs B connected to C.  
 2) = Reading for: Open throttle, hold engine speed at 1500 min<sup>-1</sup>.  
 3) = Reading for: Air conditioner additionally switched on (if applicable).  
 4) = Reading for: Run engine at idle and set air conditioner to "defrost".

#### Trouble-shooting:

To test, disconnect control unit plug from the test adapter. If necessary, use a wiring diagram.

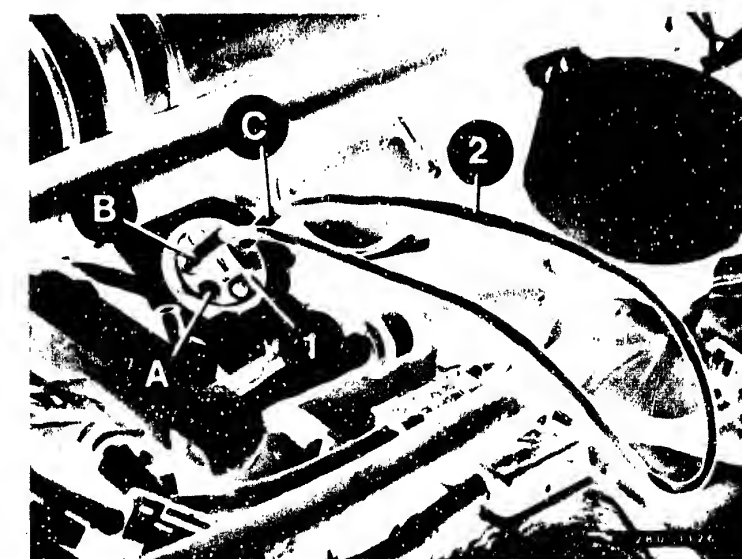
If the reading is not within tolerance, check whether or not the correct settings have been made.

If the settings are OK, take out and replace the control unit.



Top view of control unit plug

- 1 = Test socket  
 2 = Test lead (user-fabricated)  
 B = Test output of idle-speed control  
 C = Ground test output



**E17**

Test chart for universal test adapter  
 Porsche 928 S USA

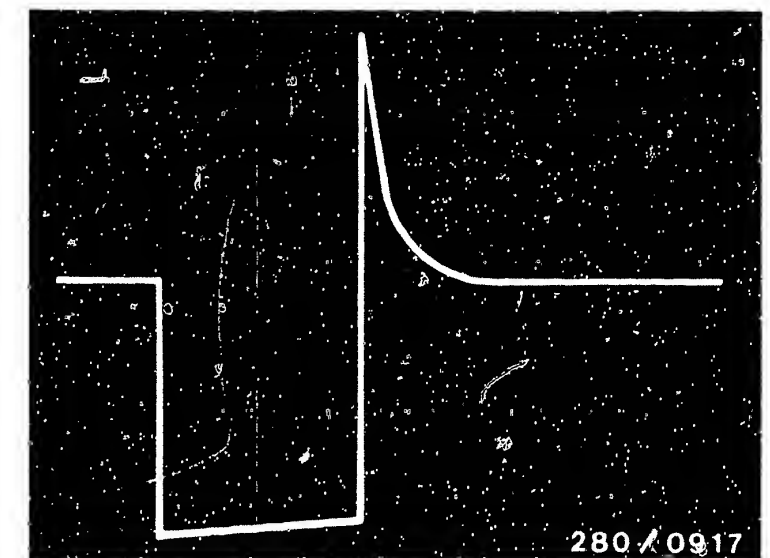


**E18**

Test chart for universal test adapter  
 Porsche 928 S USA



TEST STEP 24 Connect adapter lead to control unit and peripherals.			
Operation		Reading	Testing of control unit
Program switch "V" at position	12	Measuring equipment must indicate  <u>injection signal.</u>  (See diagram at top right).	Component:  Control unit
Program switch "Ω" at position	24		Operation:  Output stage
Measuring equipment: Ignition oscilloscope			
Measuring range: ms/20 V special input			
Connection: Red test socket/well = pos. Black test socket/well = ground		<div><div>Yes</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div><div>No</div><div></div></div>	Malfunction:  No injection signal or incorrect injection signal
Operation in vehicle: Warm up engine and run			



Injection signal

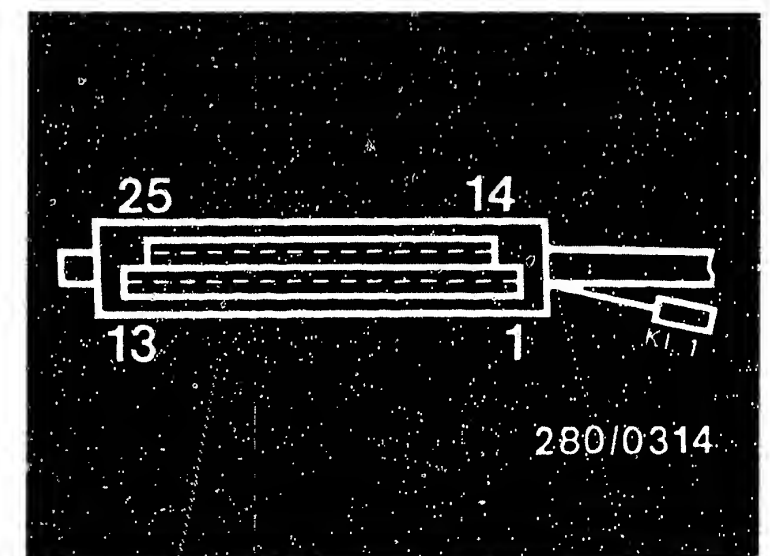
Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

If no injection signal visible on oscilloscope, change triggering. (Move clamp-on pickup to a different cylinder).

No injection signal or incorrect injection signal: Replace control unit.

Top view of control-unit plug



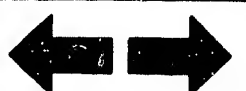
**E19**

Test chart for universal test adapter  
Porsche 928 S USA

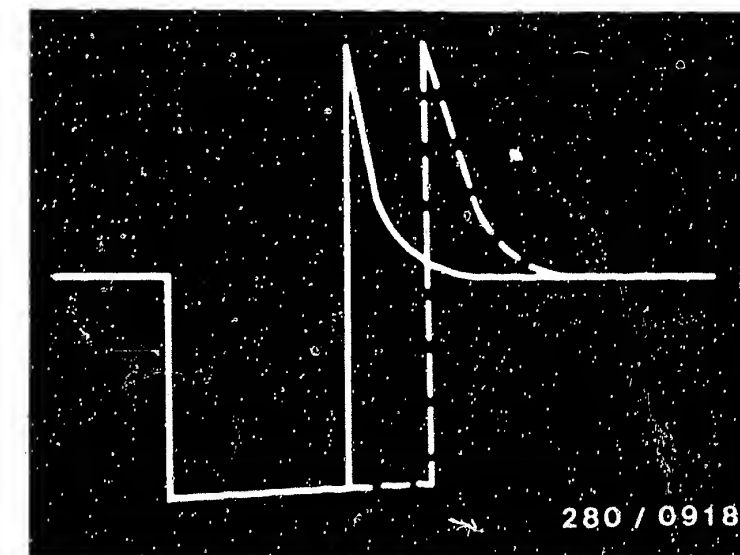


**E20**

Test chart for universal test adapter  
Porsche 928 S USA

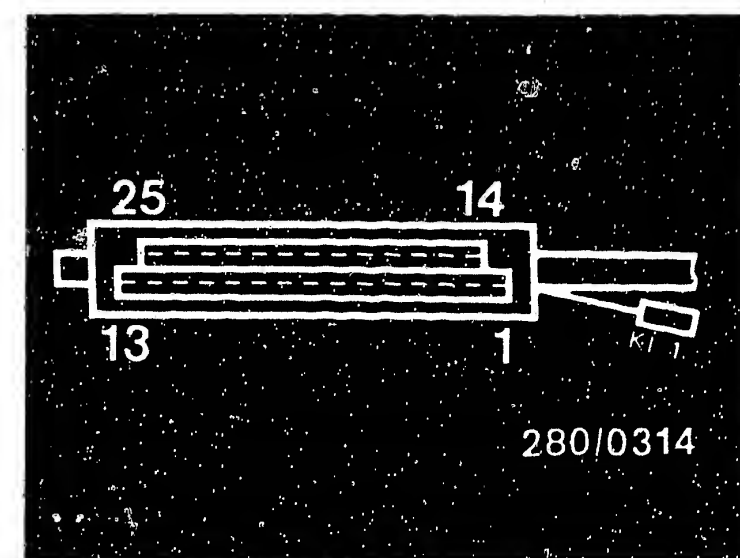


TEST STEP 25    Connect adapter lead to <u>control unit and peripherals.</u>			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing of control unit:</u>
<u>Program switch "V"</u> <u>at position</u>	12	Measuring equipment must indicate injection signal. After pressing button T1 (NTC II-cold) engine speed rises above 2000 min <sup>-1</sup> and/or injection pulse becomes wider. (see top diagram). <u>Press button only</u> <u>briefly.</u> (Heavy enrich- ment).	<u>Component:</u>  Control unit
<u>Program switch "Ω"</u> <u>at position</u>	24		
<u>Measuring equipment:</u> Ignition oscilloscope			
<u>Measuring range:</u> ms/20 V special input			<u>Operation:</u>  Influence of cold tempera- ture (engine)
<u>Connection:</u> Red test socket/well = pos. Black test socket/well = ground			
<u>Operation in vehicle:</u> Warm up engine and run		<div><div>Yes</div><div>Continue test- ing with <u>next</u> <u>test step.</u></div></div> <div><div>No</div><div></div></div>	<u>Malfunction:</u>  After pressing button T1 injection signal does not become wider.
Press button 1			



Widened injection signal after pressing button T1

Top view of control-unit plug



#### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Injection pulse does not become wider/no increase in engine speed → replace control unit.

**E21**

Test chart for universal test adapter  
Porsche 928 S USA



**E22**

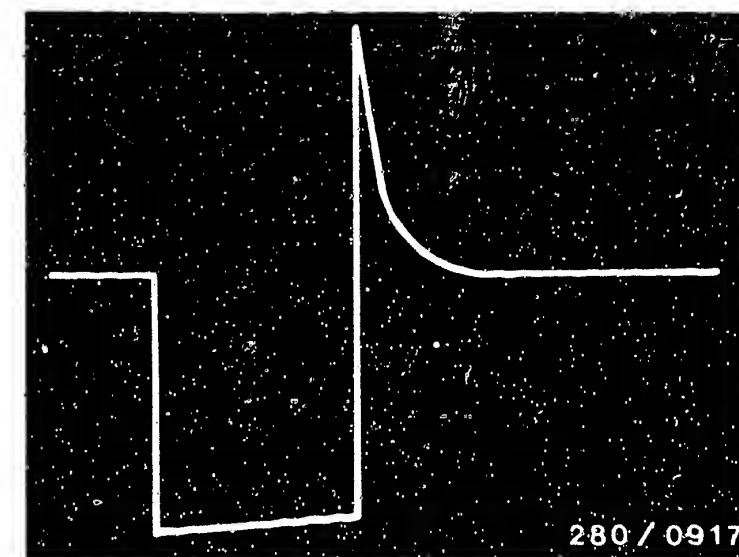
Test chart for universal test adapter  
Porsche 928 S USA





# **TEST STEP 26** Connect adapter lead to control unit and peripherals.

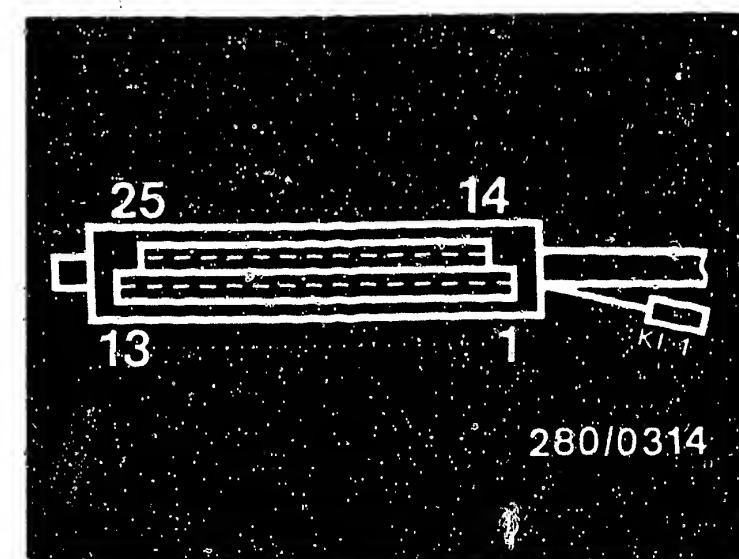
Operation:		Reading:	Testing of control unit:
Program switch "V" at position	12	Measuring equipment must indicate  injection signal.  After pressing T2 in- jection signal must not become wider. The engine speed must not increase (see top diagram).	Component: Control unit
Program switch "Ω" at position	24		
Measuring equipment: Ignition oscilloscope			
Measuring range: ms/20 V special input		<div>Yes</div> <div>No</div>	Operation: Influence of warm temperature (engine)
Connection: Red test socket/well = pos. Black test socket/well = ground			Malfunction: After pressing button T2 injection signal becomes wider.
Operation in vehicle: Warm up engine and run			
Press button 2		Continue test- ing with <u>next</u> test step.	



Injection signal

280 / 0917

Top view of control-unit plug



280/0314

## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

If injection signal becomes wider, engine is not at normal operating temperature. Let engine run at 3000 min<sup>-1</sup> for approx. 5 minutes. Repeat test.

If fault not remedied, replace control unit.

**E23**

Test chart for universal test adapter  
Porsche 928 S USA



**E24**

Test chart for universal test adapter  
Porsche 928 S USA





# TEST STEP 27 Connect adapter lead to control unit and peripherals.

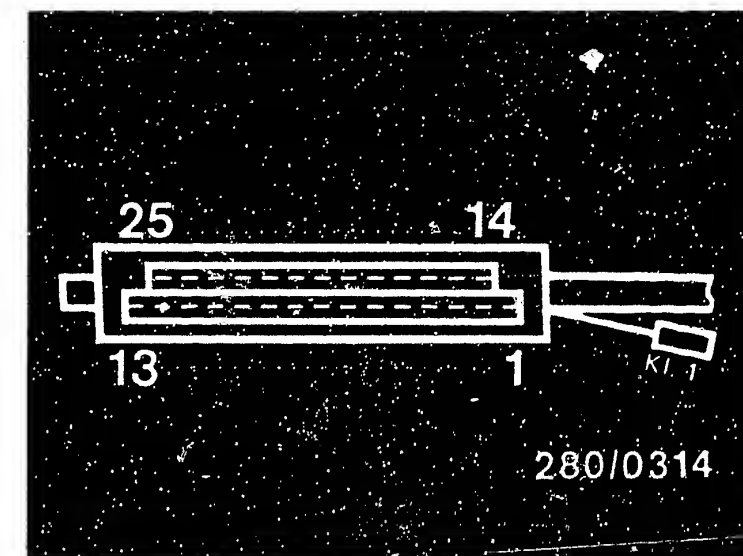
<u>Operation:</u>		<u>Reading:</u>	<u>Testing of control unit:</u>
<u>Program switch "V"</u> <u>at position</u>	12	Measuring equipment must <u>briefly</u> indicate <u>no injection pulses*</u> .	<u>Component:</u> Control unit
<u>Program switch "Ω"</u> <u>at position</u>	24		
<u>Measuring equipment:</u> Ignition oscilloscope			
<u>Measuring range:</u> ms/20 V special input			
<u>Connection:</u> Red test socket/well = pos. Black test socket/well = ground			
<u>Operation in vehicle:</u> Warm up engine and run		<div><div>Yes</div><div>↓</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div><div>No</div><div>↓</div></div>	<u>Operation:</u> Overrun cutoff
Press button 5			<u>Malfunction:</u> Injection signals

## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

- \* Hold engine speed constant at  $2000 \text{ min}^{-1}$ .  
Press button 5.  
Injection signals stop and start again at approx.  $1300 \text{ min}^{-1}$ .  
Release button 5 and press again (hold engine speed constant).  
The same must happen again.

If incorrect, replace control unit.



Top view of control-unit plug

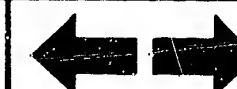
**F1**

Test chart for universal test adapter  
Porsche 928 S USA

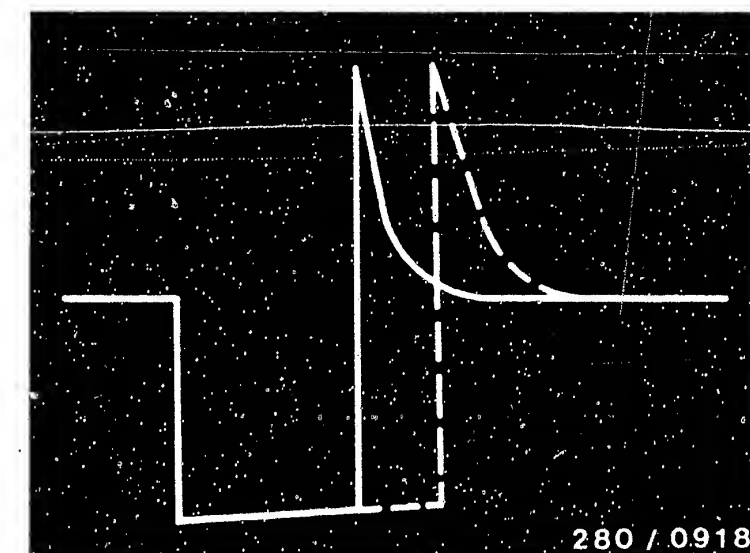


**F2**

Test chart for universal test adapter  
Porsche 928 S USA

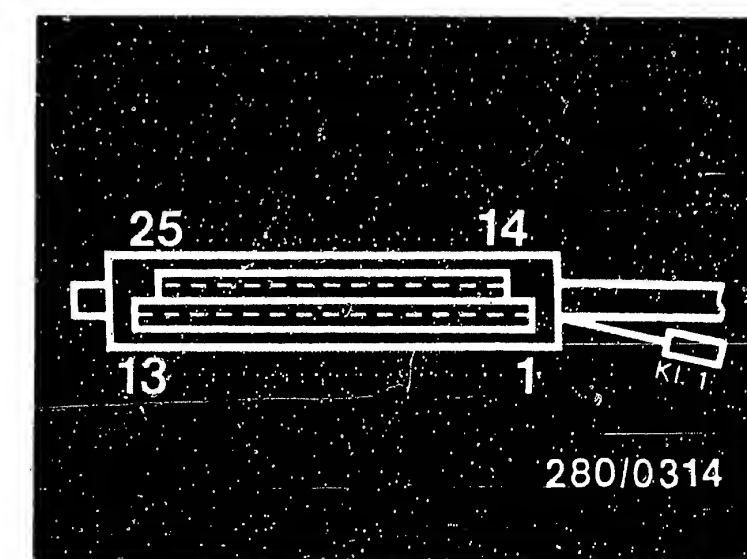


TEST STEP 28    Connect adapter lead to <u>control unit and peripherals.</u>			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing of control unit:</u>
<u>Program switch "V"</u> <u>at position</u>	12	Measuring equipment must indicate  <u>injection pulse.</u>  After pressing button T6 (full-load enrich- ment) injection signal <u>must become slightly</u> <u>wider</u> (see top diagram).	<u>Component:</u>  Control unit
<u>Program switch "Ω"</u> <u>at position</u>	24		
<u>Measuring equipment:</u> Ignition oscilloscope			
<u>Measuring range:</u> ms/20 V <u>special input</u>			<u>Operation:</u>  Full-load enrichment
<u>Connection:</u> Rest test socket/well = pos. Black test socket/well = ground			
<u>Operation in vehicle:</u> Warm up engine and run			<u>Malfunction:</u>  Injection signal does not become wider
Press button 6		Yes ↓ Continue test- ing with <u>next</u> <u>test step.</u>	No ↓



Widened injection signal after pressing button T6

Top view of control-unit plug



### Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

If the injection pulse does not become wider, the engine speed must become higher. If the injection signal does not become wider or the engine speed does not become higher and the driver complains about "maximum engine power not reached" - replace control unit.

**F3**

Test chart for universal test adapter  
Porsche 928 S USA



**F4**

Test chart for universal test adapter  
Porsche 928 S USA



# TEST STEP 29 Connect adapter lead to control unit and peripherals.

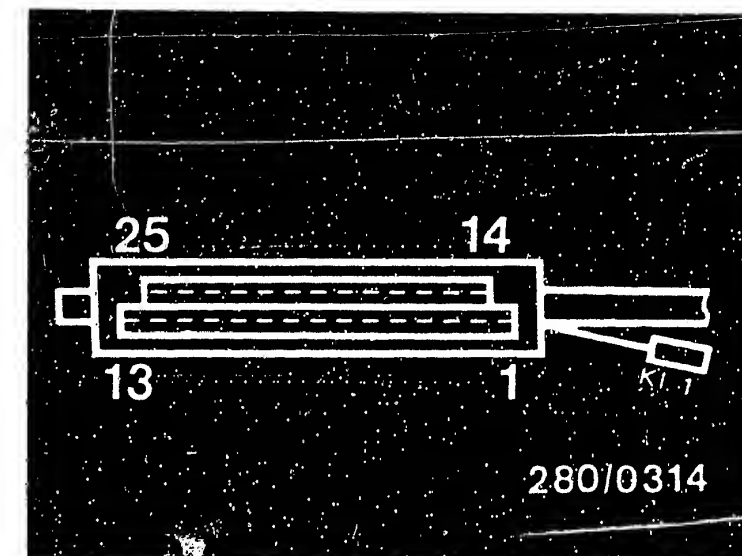
Operation:		Reading:	Testing of control unit:
Program switch "V" at position	13	After approx. 4 sec. measuring equipment must indicate a voltage of 2...5 V. (reading lasts approx. 1 sec.).	Component: Control unit
Program switch "Ω" at position	24		
Measuring equipment: Motor-tester/multimeter			
Measuring range: 10 V			Operation: Self-cleaning (term. 8 to term. 11)
Connection: Red test socket/well = pos. Black test socket/well = ground		Yes ↓ Continue testing with fuel pressure test.	Malfunction: Continuous pulse or no pulse
Operation in vehicle: Warm up engine and bring to min. 2000 min <sup>-1</sup> . (Briefly). Then ignition "OFF"		No ↓	

## Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (Set value approx. 0 Ω):

- From control-unit plug term. 8 to hot-wire air-mass sensor term. 1.
  - Self-cleaning pulse not as per reading - remove hot-wire air-mass sensor, leave plug on. Repeat test step 29 and observe the hot wire (look into hot-wire air-mass sensor tube).
  - After approx. 4 sec hot wire must glow for approx. 1 sec.
- Hot wire glowing: Check connections and/or setting of measuring instrument.  
Hot wire not glowing: Engine temperature below +60°C. Let engine warm up.  
Repeat test. Hot wire still not glowing? Hot wire in hot-wire air-mass sensor broken. Replace hot-wire air-mass sensor. If hot wire not broken, replace control unit.  
Eliminate contact resistances at the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.



Top view of control-unit plug

1 = Hot wire



F5

Test chart for universal test adapter  
Porsche 928 S USA



F6

Test chart for universal test adapter  
Porsche 928 S USA



Testing with the universal test adapter is now completed.

The fuel pressure test must now be performed.

If a fault is found during a test, the test must be repeated after the fault has been eliminated.

The fuel pressure test is on Coordinates F8...F21.

**F7**

Test chart for universal test adapter  
Porsche 928 S USA



## FUEL PRESSURE TEST

yes

Electric fuel pump operating?

Listen.

no

Crank the engine during the following voltage measurements. (Do not overload starting motor)

Check pump relay

- Voltage measurement at central-electrics box plug Q No. 11/12.  
If no voltage:  
No voltage signal from the two ignition coils term. 15 or open circuit in leads.  
Check ignition system.

If voltage present:

- Voltage measurement between central-electrics box plug W No. 11/12 (positive terminal) and W No. 15 (negative terminal).

If no voltage:

Open circuit in lead to LH control unit term. 17 or no ground signal from control unit. Remedy fault.

If voltage present:

- Voltage measurement at central-electrics box plug W No. 13.

If no voltage:

Check voltage at central-electrics box plug U No. 12.

If voltage present - replace pump relay.

If no voltage:

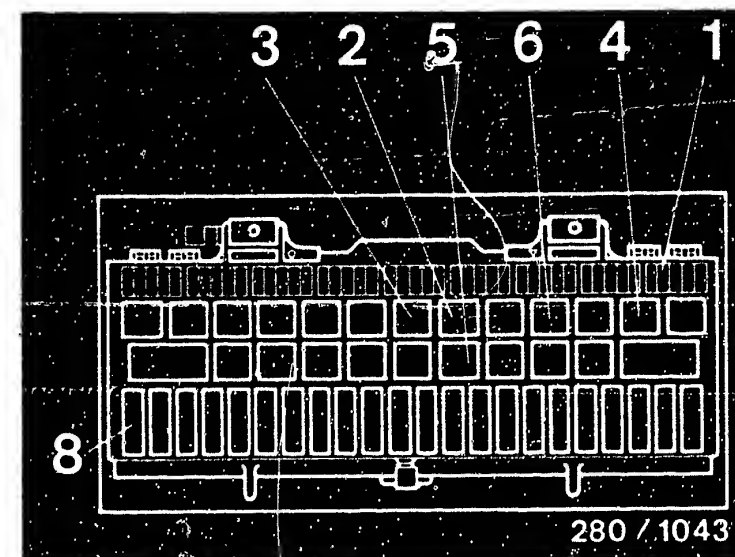
Check lead to battery (positive terminal) for continuity.

Set value: approx. 0  $\Omega$ .

yes

Continued on F10/F11

Continued on F10/F11



Central-electrics box

6 = Pump relay

8 = Central-electrics box plug

**F8**

Fuel pressure test  
Porsche 928 S USA



**F9**

Fuel pressure test  
Porsche 928 S USA



## Fuel pressure test (continued)

yes

Continued on F12/F13

If voltage present:

Check pump fuse No. 42 (Top diagram-Item 1)

- Measure voltage at central plug U No. 5

If no voltage:

Replace pump fuse.

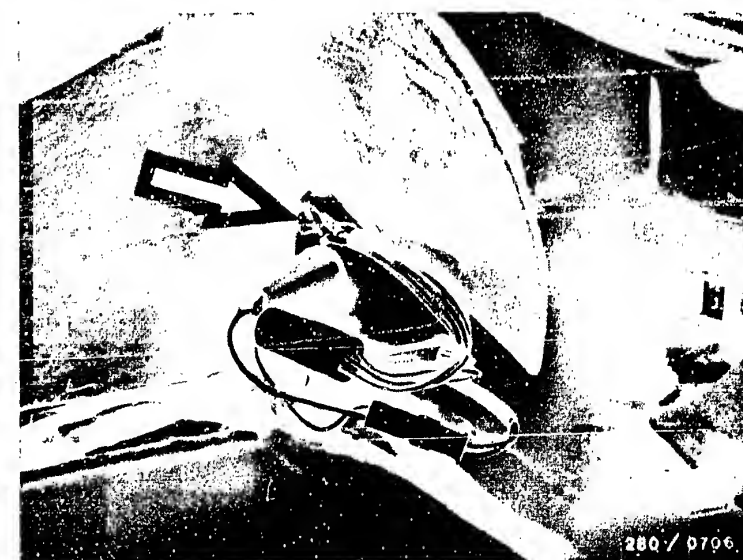
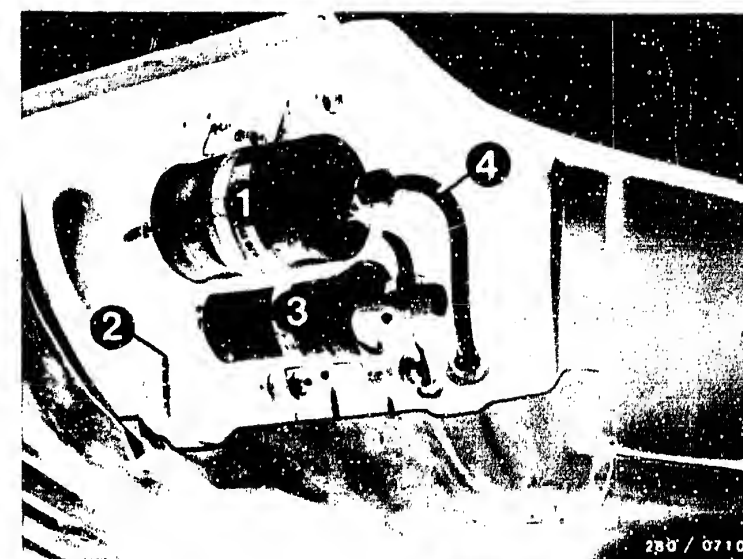
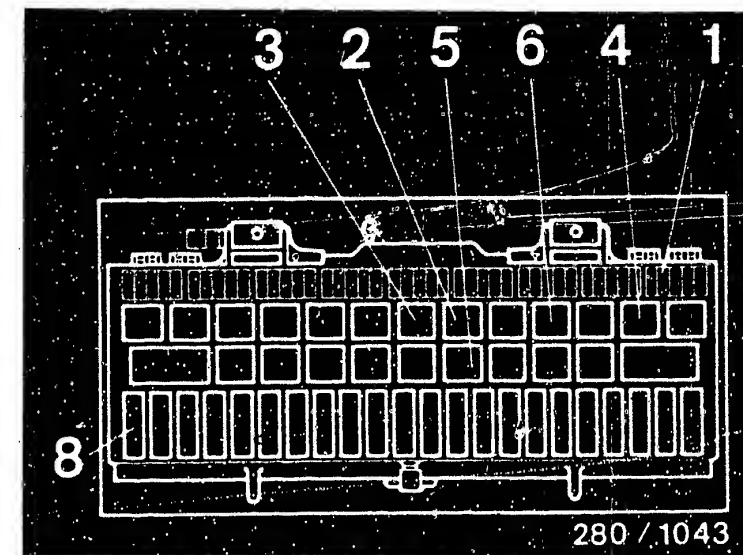
If voltage present:

- Measure voltage directly at electric fuel pump (center picture No. 3).

If no voltage (set value min. 12 V):

Check lead between central plug U No. 5 and electric fuel pump for continuity and good electrical contact.

- Ground connection of electric fuel pump O.K.? (Bottom picture, arrow). (Behind rear side panelling on right). Check ground contact. Establish good ground connection.
- Despite voltage present, electric fuel pump not operating: Replace electric fuel pump.



**F10**

Fuel pressure test  
Porsche 928 S USA



**F11**

Fuel pressure test  
Porsche 928 S USA





## Fuel pressure test (continued)

yes

Fuel pressure O.K.?

- Test specification:  
2.3...2.7 bar

Test specification reached?

no

### Testing the fuel pressure

- Connect pressure gauge/pressure tester.  
Unscrew screw plug on fuel-distribution  
pipe. Do not lose ball.

Caution: When opening the screw plug, make  
sure that no fuel gets onto hot parts of  
the engine.

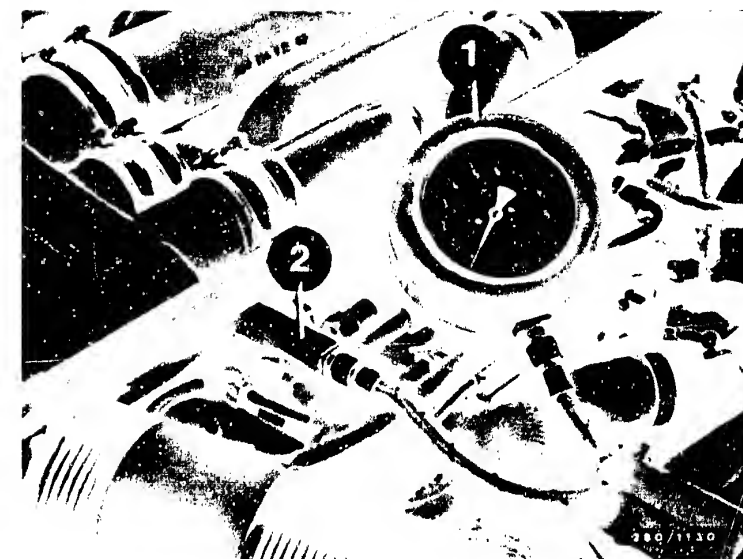
#### Note:

After removing the pressure gauge, the screw  
plug on the fuel-distribution pipe must be  
tightened to 12 Nm. Do not forget ball.

yes

Continued on F18/F19

Continued on F14/F15



- 1 = Pressure gauge  
2 = Connection point  
(right-hand fuel-distribution  
pipe at front)

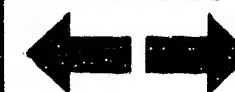
**F12**

Fuel pressure test  
Porsche 928 SUSA



**F13**

Fuel pressure test  
Porsche 928 S USA



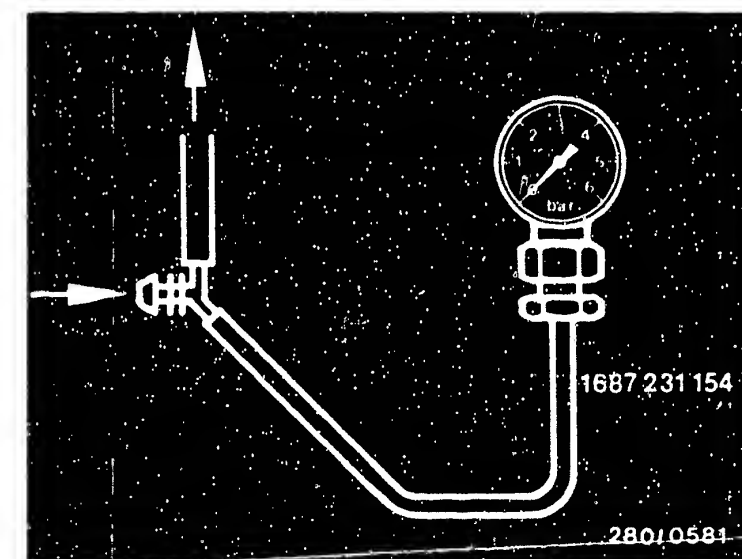
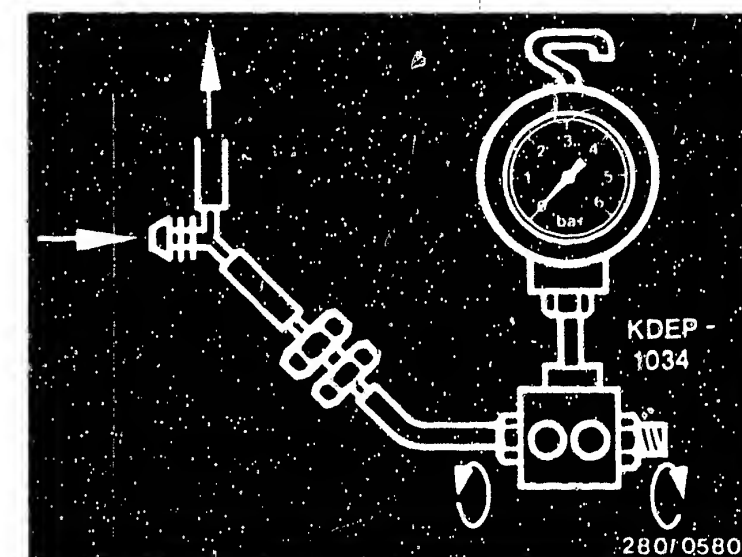
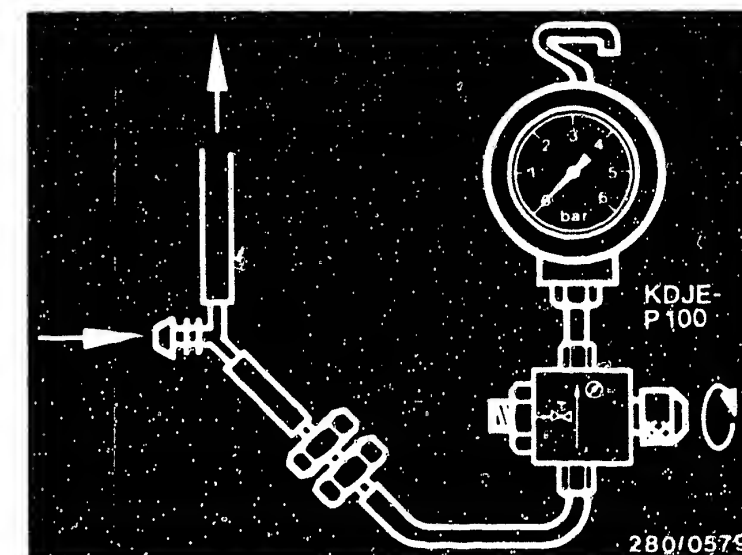
# Fuel pressure test (continued)

## Testing the fuel pressure

Connect connections of pressure tester into the fuel delivery line. If using pressure tester KDJE-P 100, close the valve screw. If using KDEP 1034, close only the right-hand one. The end of the hose is plugged onto the fuel-distribution pipe; the free Y-piece connection is plugged onto the fuel delivery hose.

Make sure there are no leaks.

yes



Continued on F18/F19

Continued on F16/F17

**F14**

Fuel pressure test  
Porsche 928 S USA



**F15**

Fuel pressure test  
Porsche 928 S USA



# Fuel pressure test (continued)

## • Jumping the safety circuit

Central-electrics box behind cover plate in front passenger footwell. Take away floor mat and hinge up running plate. Disconnect pump relay (top diagram - Item 6) and insert jumper between term. 30 and term. 87.

### Bottom picture

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base

Switch on ignition. Read off fuel pressure on pressure gauge.

Fuel pressure:

Test specification: 2.3 ... 2.7 bar

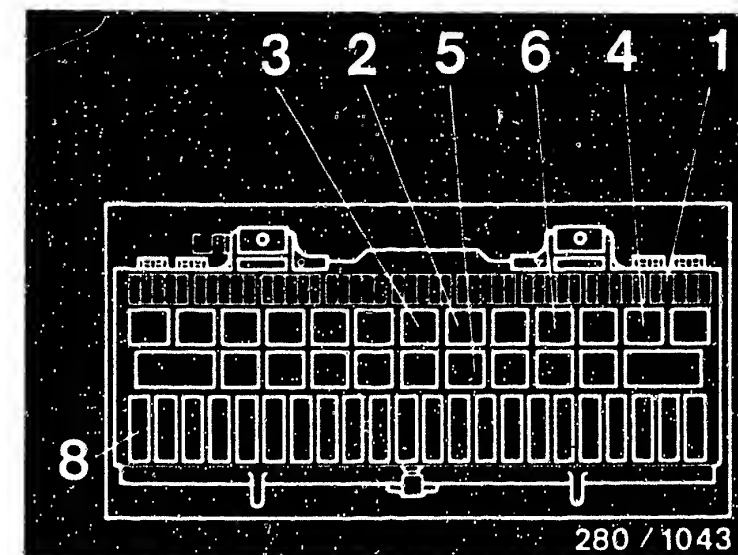
Switch off ignition. Remove jumper and re-insert pump relay (top diagram - Item 6).

Start engine and run. Fuel pressure drops to approx. 2.0 bar (dependent on intake-manifold pressure).

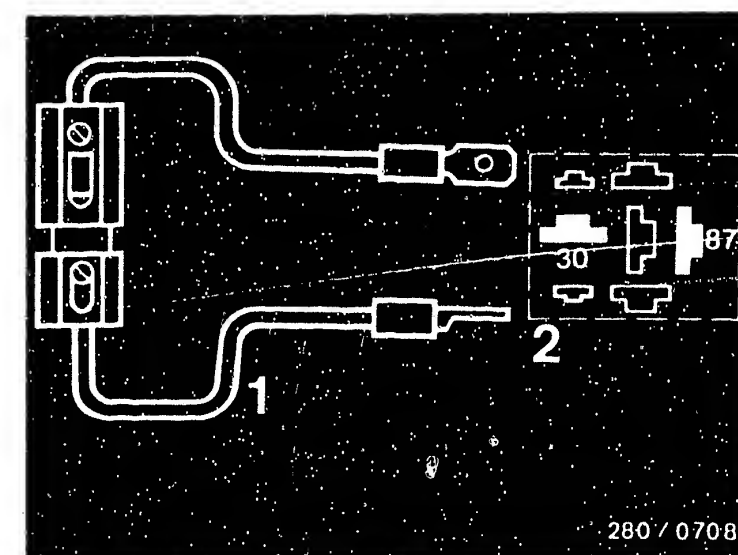
If not - trouble-shooting on pressure regulator.

yes

Continued on F18/F19



6 = Pump relay



F16

Fuel pressure test  
Porsche 928 S USA



F17

Fuel pressure test  
Porsche 928 S USA



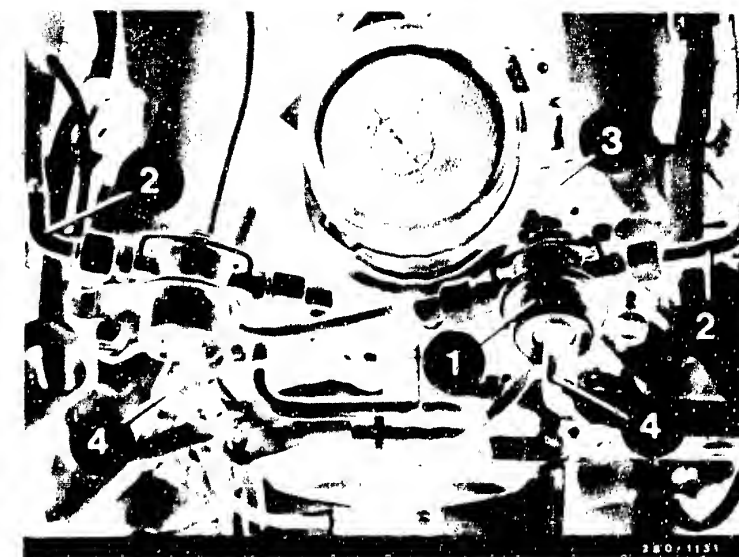
## Fuel pressure test (continued)

Fuel pressure O.K.?  
Pressure regulator O.K.?  
Test specification:  
2.3...2.7 bar  
Test specification reached?

no

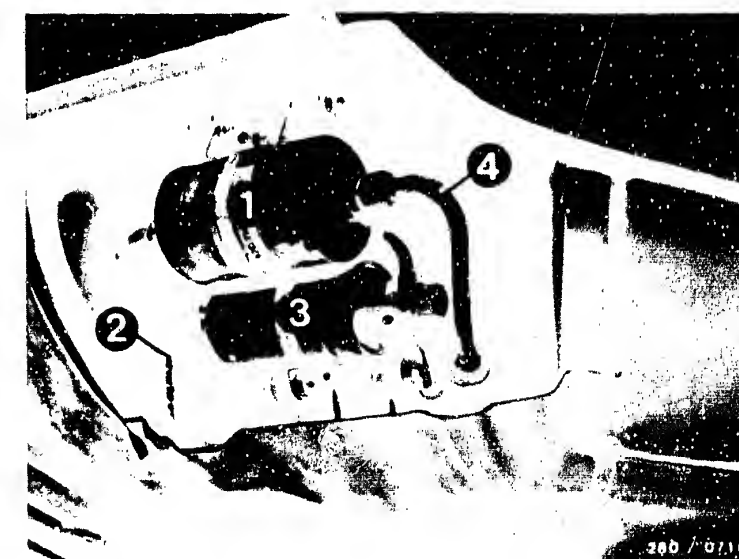
yes

- Testing the pressure regulator  
Start engine and run.  
Test specification for fuel pressure:  
approx. 2.0 bar  
Disconnect vacuum hose from right-hand pressure regulator.  
Test specification for fuel pressure:  
2.3...2.7 bar  
Fuel pressure of 2.3 bar not reached:
- Slowly pinch off common fuel delivery line.  
Caution: Do not load pressure gauge above 6 bar.  
If pressure rises above 4 bar - replace pressure regulator. Pressure regulator is mounted on fuel-distribution pipe by means of hose lines.
- Fuel return line, fuel filter or pressure damper clogged.
- Strainer in tank clogged.
- Corrosion in tank.
- Fuel pressure of 2.7 bar exceeded:
- Fuel return line clogged or pinched.
- Replace pressure regulator.



- 1 = Pressure regulator
- 2 = Fuel delivery line
- 3 = Fuel return line
- 4 = Connection to intake manifold

- 1 = Fuel filter
- 2 = Fuel intake line
- 3 = Electric fuel pump
- 4 = Fuel delivery line



Continued on F20/F21

**F18**

Fuel pressure test  
Porsche 928 S USA



**F19**

Fuel pressure test  
Porsche 928 S USA



## Fuel pressure test (continued)

Does fuel pressure remain almost constant after engine has been switched off?

Test specification:  
2.3...2.7 bar

Test specification reached?

no

Fuel pressure drops quickly after the hot engine has been switched off.

- Check the fuel system for leaks (build up fuel pressure):  
Fuel pressure: 2.3...2.7 bar

Remove jumper and watch pressure gauge.  
After approx. 20 min the fuel pressure must still be min. 1.0 bar

If not:

- Check connections between components and fuel hoses/lines for leaks.
- Pressure regulator (diaphragm)
- Check injection valves (needle seat, valve not closing properly).
- Check electric fuel pump (leaking non-return valve - parts set 1 587 010 002)
- Pressure damper or fuel filter leaking.

yes

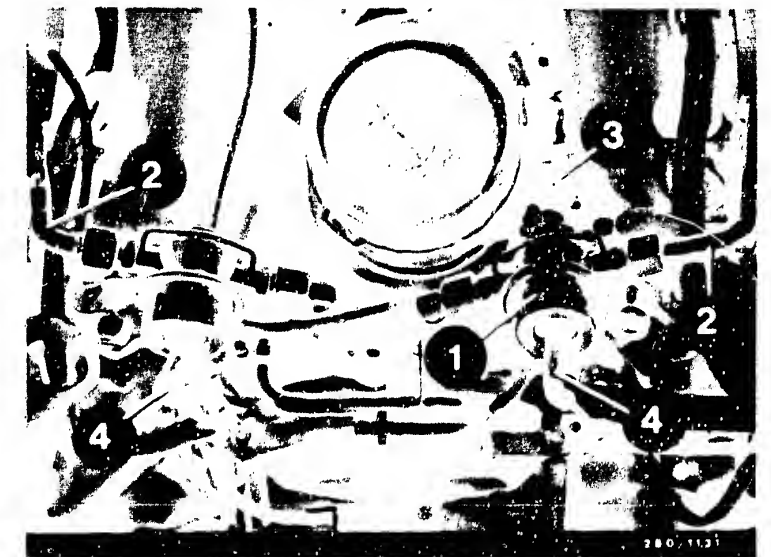
Remove pressure gauge. Connect screw plug onto fuel-distribution pipe (12 Nm).  
Caution: Do not forget ball.  
Remove jumper and insert pump relay into connection base.  
The fuel pressure test is now completed.  
If the fault has not been found or if further instructions are required on how to remedy the fault, proceed according to the trouble-shooting chart of your choice.

Detailed trouble-shooting chart

(Coordinates C3...C4)

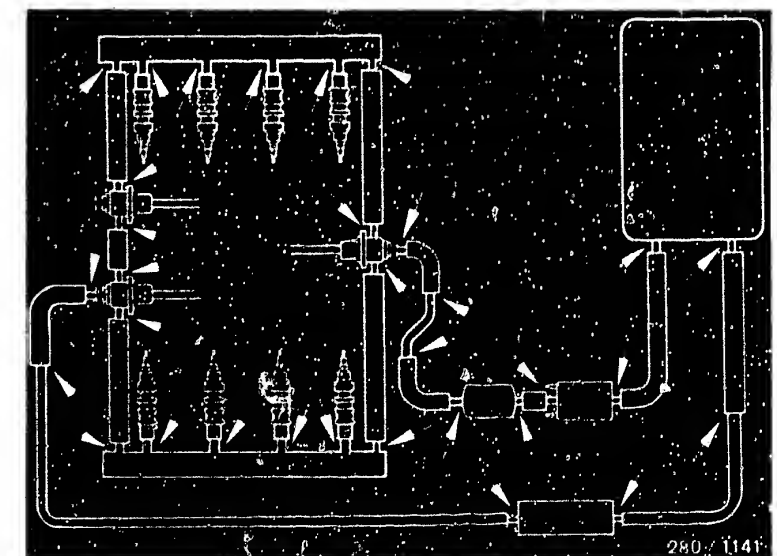
Direct trouble-shooting chart

(Coordinates C5...C8)



- 1 = Pressure regulator
- 2 = Fuel delivery line
- 3 = Fuel return line
- 4 = Connection to intake manifold

Diagram of fuel lines  
Arrows indicate connections between hoses and components.



**F20**

Fuel pressure test  
Porsche 928 S USA



**F21**

Fuel pressure test  
Porsche 928 S USA



## STARTING MOTOR OPERATES, ENGINE FAILS TO START OR STARTS ONLY WITH GREAT DIFFICULTY

Trouble-shooting program according to customer complaint

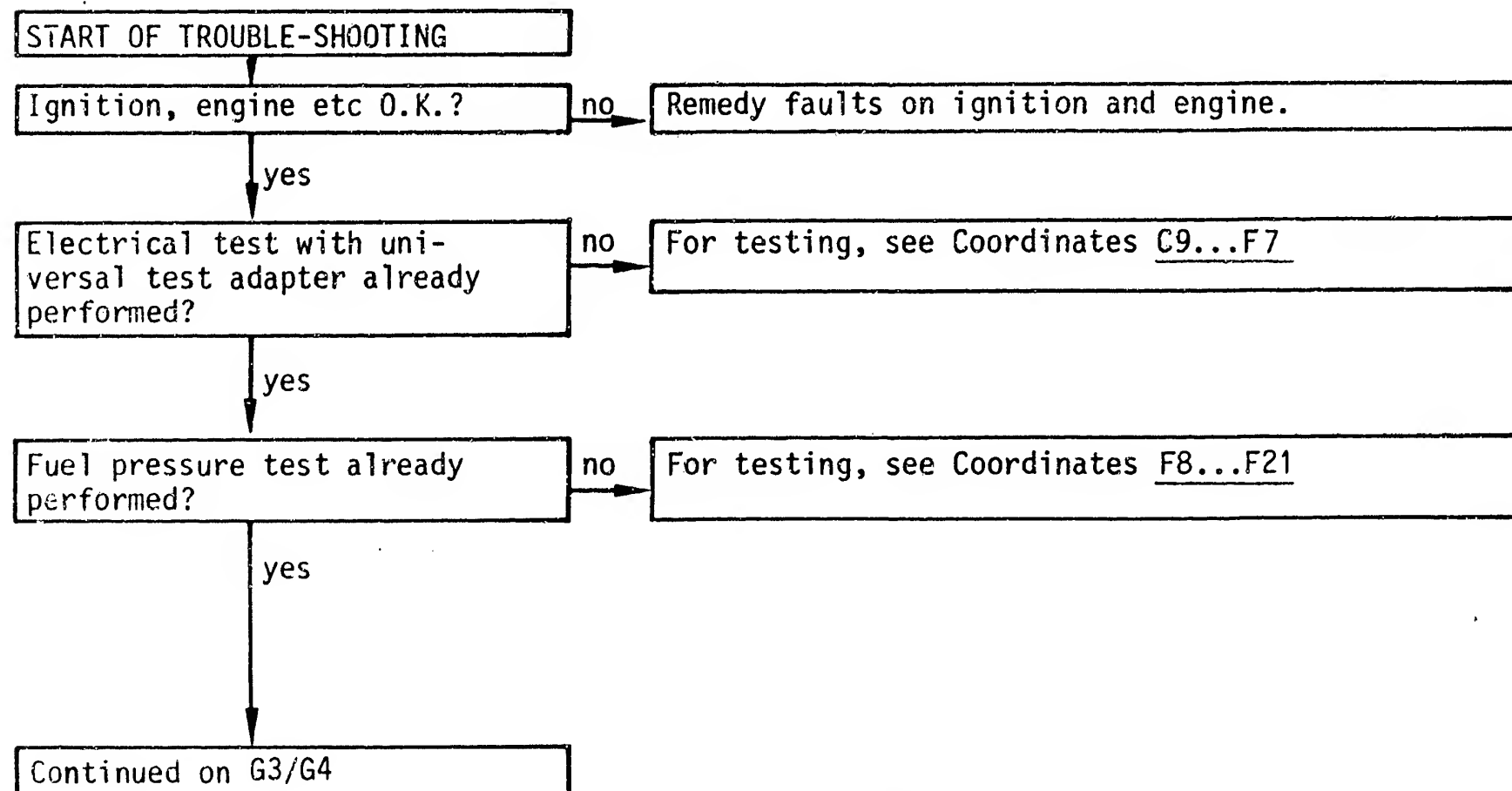
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**G1**

Engine fails to start  
Porsche 928 S USA



**G2**

Engine fails to start  
Porsche 928 S USA





Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

Cold start control O.K.?  
(Control unit function)

- Remove pump fuse (1) and unplug 2-pin plug-in connection above central-electrics box.
- Connect test lead between an injection valve.
- Disconnect plug from engine temperature sensor II (double NTC). Colour of plug blue.
- Connect motortester/multimeter to test lead. (Setting V, measuring range 10 V). Start engine. Voltage at injection valve must drop during starting from approx. 4 V to approx. 0.5 V (with engine at normal op. temp. or with NTC II plug connected, the voltage is less than 0.5 V). After testing, re-establish the original condition.

yes

Continued on G7/G8

No

Functional test:

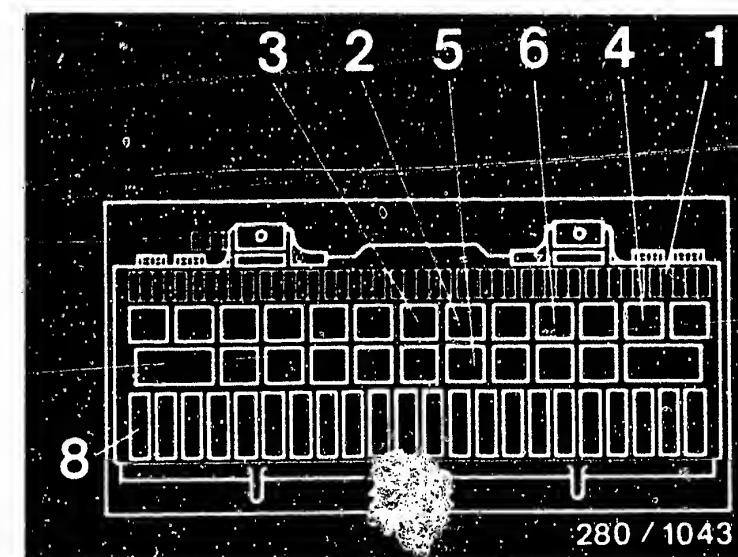
- Hinge up running plate (front passenger footwell cover plate behind the floor mat).
- Remove pump fuse (1) No. 42.
- Unplug 2-pin plug-in connection above the central-electrics box. (Green and white shielded connecting leads).

Continued on G5/G6



1 = 2-pin plug connector

Central-electrics box  
1 = Pump fuse (No. 42)



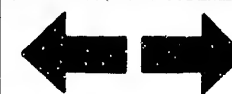
G3

Engine fails to start  
Porsche 928 S USA



G4

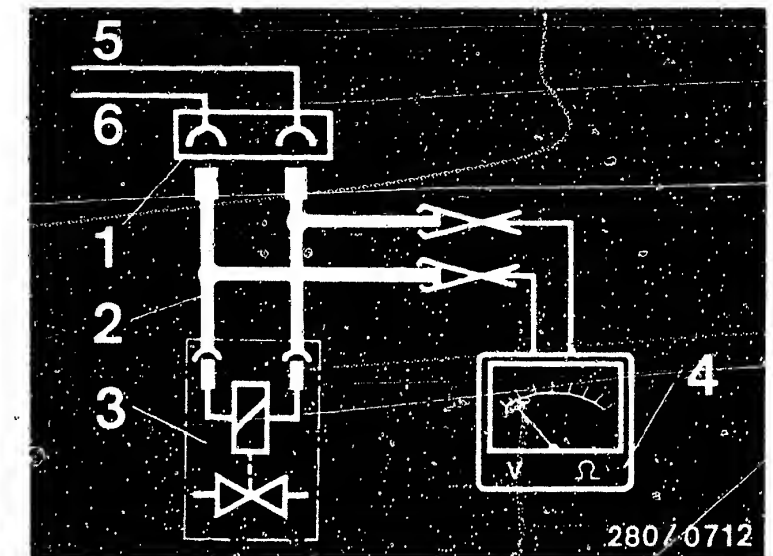
Engine fails to start  
Porsche 928 S USA



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

- Connect test lead 1 684 463 093.  
Connect 2-pole test lead 1 684 463 093 between an injection valve and its electrical connecting lead.
  - Connect multimeter to unoccupied measuring poles. Measuring range approx. 10 V.
  - Disconnect plug from temperature sensor II (engine).  
(Double NTC, colour of plug blue). Engine must not start while the starting motor is operated.
  - Measuring:
    - Crank engine
    - Voltage reading drops from initially approx. 4 V within approx. 10 s cranking time to approx. 0.5 V. If voltage readings not obtained, replace control unit.
    - Wait approx. 1 minute before repeating test.
    - Connect plug to temperature sensor. If engine at normal operating temperature, start. Voltage reading less than 0.5 V. If voltage reading not as stated, replace temperature sensor II (double NTC).
- Caution:  
After testing, re-establish the original condition.



- 1 = Connector of injection valve lead
- 2 = Test lead 1 684 463 093
- 3 = Injection valve
- 4 = Multimeter/motortester
- 5 = From central-electrics box plug W No. 13
- 6 = From control unit term. 13

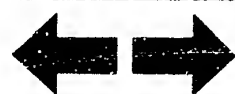
1 = Temperature sensor II



Continued on G7/G8

**G5**

Engine fails to start  
Porsche 928 S USA



**G6**

Engine fails to start  
Porsche 928 S USA



Starting motor operates, engine fails to start or starts only with difficulty (cont'd)

yes

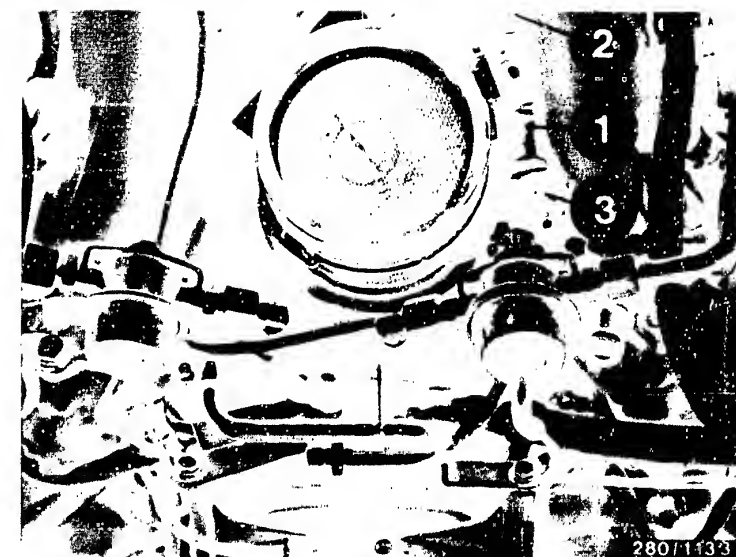
Idle actuator mechanically  
O.K.?

no

- The idle actuator is checked for correct electrical operation with the universal test adapter.
- Mechanical test  
Removal of hot-wire air-mass sensor
- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition).
- Remove housing bottom part.
- Warning: Remove bottom part of air filter housing and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection). Disconnect plug.
- Removal of idle actuator  
The idle actuator is checked for freedom of movement as follows:
  - Remove idle actuator (disconnect hoses).
  - Disconnect plug. Connect center connection (term. 2) to battery voltage.
  - Connect outer connection (term. 1) to ground.
  - Visually examine whether the rotary slider turns to the limit stop.
  - Change over outer connection, i.e. connect term. 3 to ground. Rotary slider must now turn to opposite stop.Replace idle actuator if defective.  
When installing the idle actuator, pay attention to its direction of flow (arrow).
- Re-establish the original condition.

yes

Continued on G9/G10



1 = Idle actuator  
2 = Connecting hoses  
3 = Plug

**G7**

Engine fails to start  
Porsche 928 S USA



**G8**

Engine fails to start  
Porsche 928 S USA



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

Injection valves checked for proper operation?

- Diagram shown opposite visible on oscilloscope?
- No deviation or missing or interference detectable?

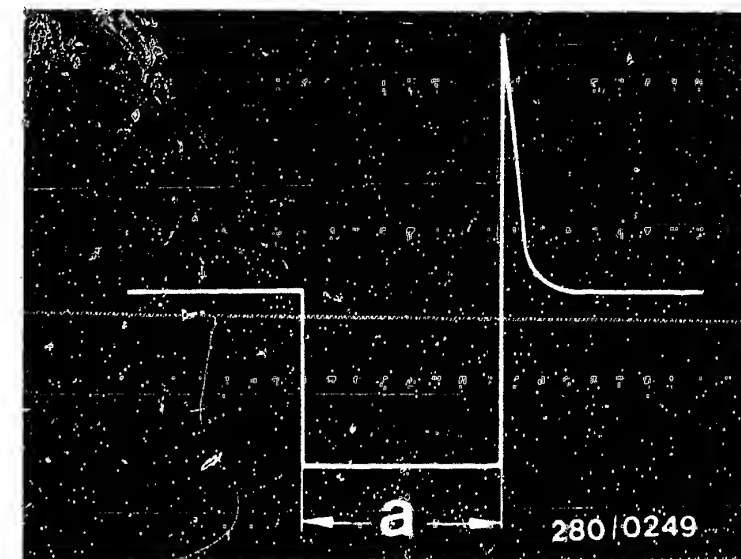
no

#### Functional test of injection valves

- Connect test lead as follows:  
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one need be connected to the special input of the motortester.
- Caution:  
The unoccupied terminal must not come into contact with the bodywork.
- If correctly connected, the pattern shown opposite is visible on the oscilloscope. With the aid of the test lead it is possible to test the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if deviations (interference, missing etc) are visible, the other injection valves should also be tested.
- In case of interference: Check routing of leads.
- In case of missing: Eliminate loose contacts in the leads or in the plug-in connections.

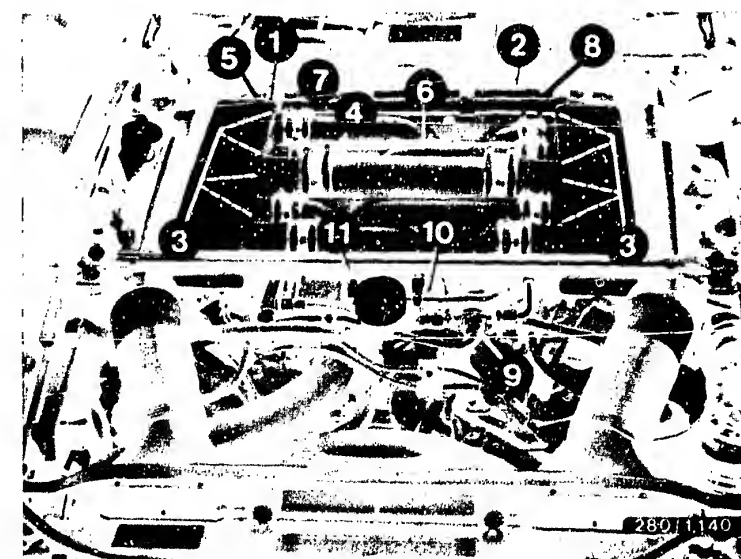
yes

Continued on G11/G12



Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load).

3 = Injection valves



**G9**

Engine fails to start  
Porsche 928 S USA



**G10**

Engine fails to start  
Porsche 928 S USA



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

Injection valves O.K.?

• Removal and installation

no

yes

Continued on G13/G14

• Removal

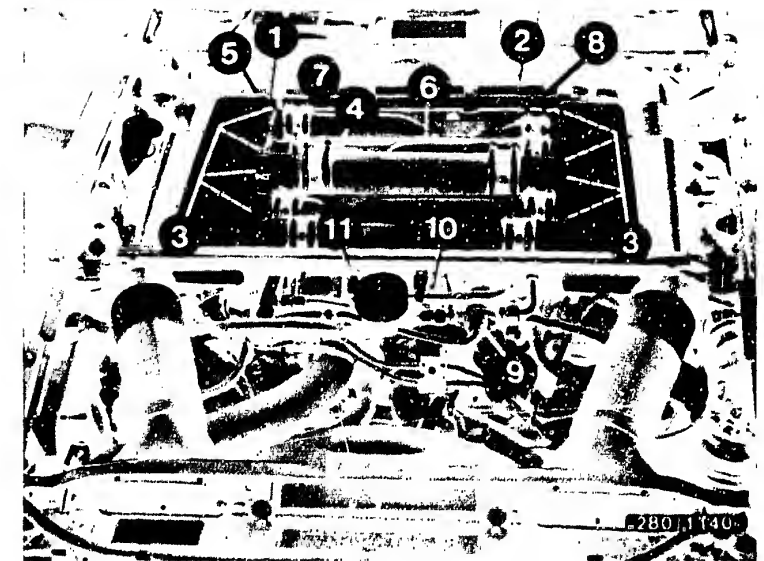
- Remove fuel-distribution pipes with injection valves.
  - Remove air-intake hoses, air filter with top and bottom parts (with hot-wire air-mass sensor).
  - Remove air-intake system left/right.
  - Loosen fastening screws on fuel-distribution pipe and on injection valves.
  - Loosen strut.
  - Pull all 8/4 injection valves simultaneously and carefully out of the cylinder.
- If injection valves defective on one side, loosen fuel-distribution pipe at pressure regulator.
- Caution: Make sure that no fuel gets onto hot parts of the engine.
- Pull off electrical connection.
  - Carefully slide holding clamp out of groove.
  - Carefully remove injection valve from fuel-distribution pipe.

Caution: Do not allow escaping fuel to drip onto hot parts of the engine.

Warning: Before installation, the O-rings must be greased only lightly (silicone grease FT 2 v 1). The other parts must remain free of grease.

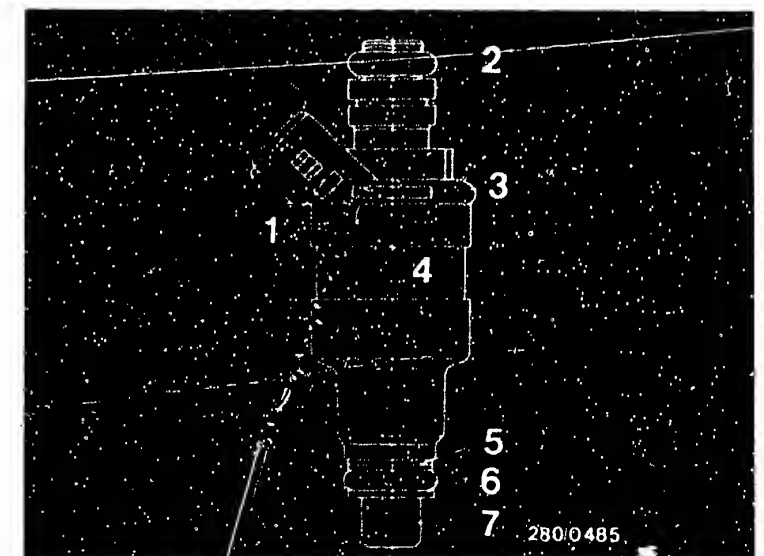
• Installation

- Carefully connect new solenoid-operated injection valve to fuel-distribution pipe.
- Slide holding clamp into groove until it latches (check O-rings for leaks). Ensure that the original condition of installation is re-established.



3 = Injection valves

- 1 = FD mark
- 2 = Upper O-ring
- 3 = Part number
- 4 = Injection valve
- 5 = Supporting plate
- 6 = Lower O-ring
- 7 = Protective sleeve



G11

Engine fails to start  
Porsche 928 S USA



G12

Engine fails to start  
Porsche 928 S USA





Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

Hot-wire air-mass sensor  
mechanically and elec-  
trically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?

Between term. 6 and term. 3:  
0...1100  $\Omega$

Between term. 5 and term. 3:  
3.6...4.1  $\Omega$

no

#### Removal

- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

Warning: Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).  
Disconnect plug.

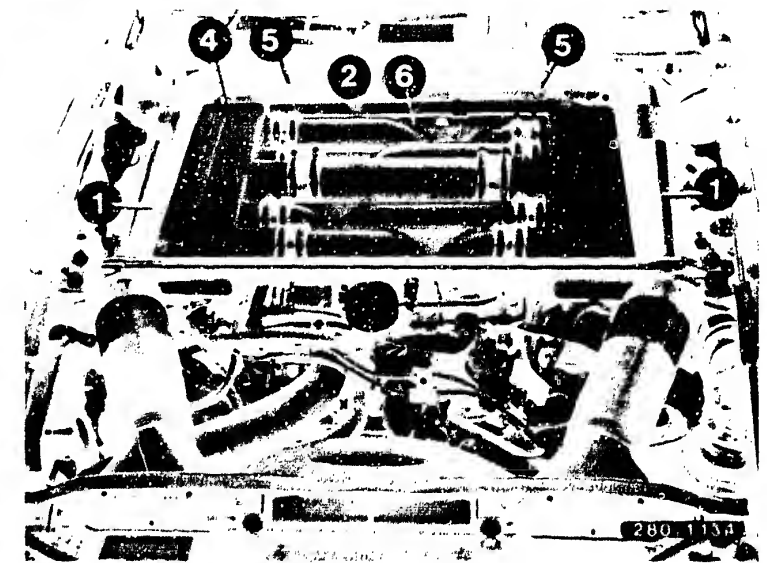
#### Visual examination

- Plug correctly connected.
  - Spring retainer snapped in position.
  - Plug not turned round.
  - No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
  - Wire screen O.K. on both sides?
- If hot wire broken - replace hot-wire air-mass sensor.

yes

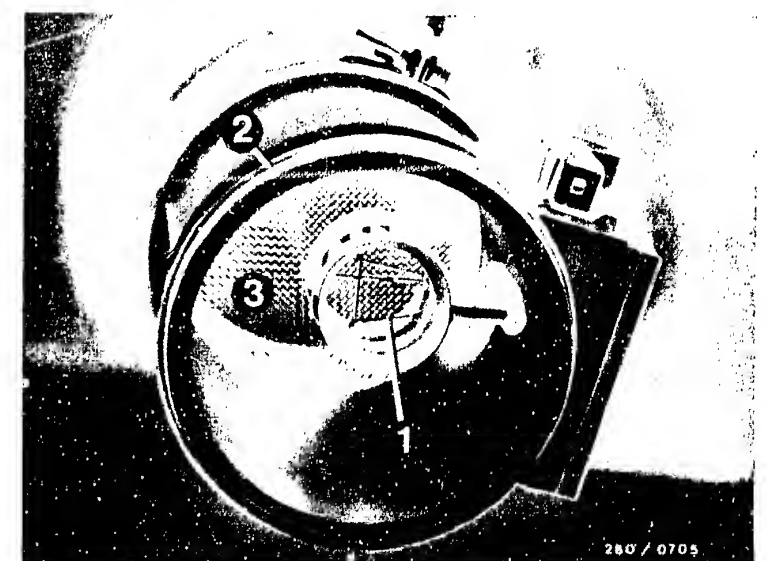
Continued on G17/G18

Continued on G15/G16



- 1 = Intake hose  
2 = Air-filter housing top part  
4 = Hose to blow-off change-over valve  
5 = Hexagon screws  
6 = Hot-wire air-mass sensor

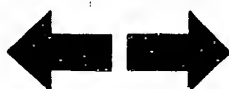
- 1 = Hot wire  
2 = O-ring (dust protection)  
3 = Wire screen



**G13**

Engine fails to start

Porsche 928 S USA



**G14**

Engine fails to start

Porsche 928 S USA





Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

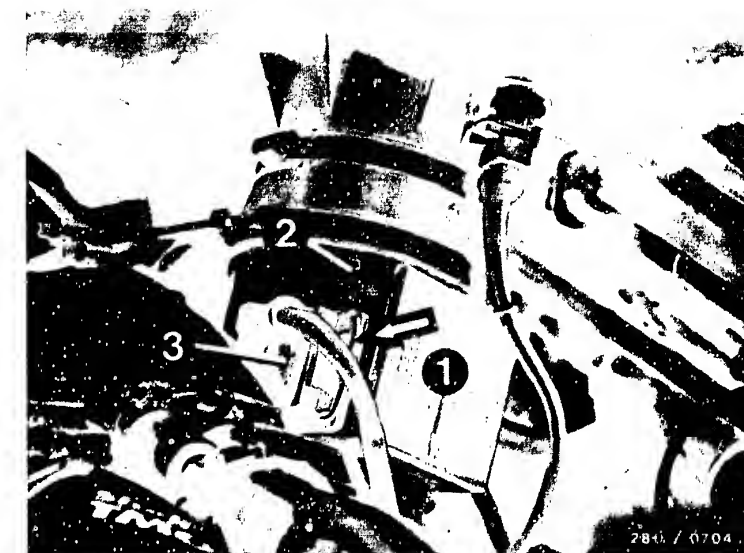
yes

• Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.  
Resistance measurement  
between term. 6 and term. 3:  
 $0...1100 \Omega$   
between term. 5 and term. 3:  
 $3.6...4.1 \Omega$   
If incorrect, replace hot-wire air-mass sensor.

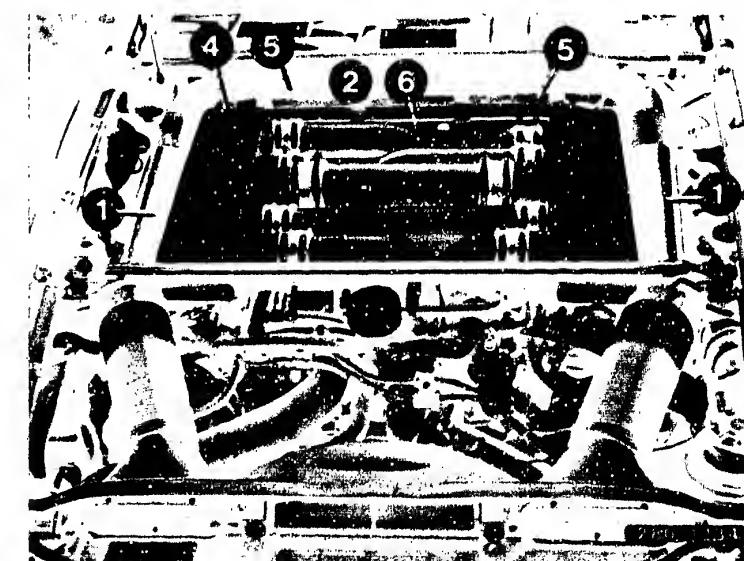
Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.



- 1 = Hot-wire air-mass sensor  
3 = Plug  
Press retainer in direction of arrow when disconnecting plug

- 1 = Intake hose  
2 = Air-filter housing top part  
3 = Air-filter housing bottom part  
4 = Hose to blow-off change-over valve  
5 = Hexagon screws  
6 = Hot-wire air-mass sensor



Continued on G17/G18

**G15**

Engine fails to start  
Porsche 928 S USA



**G16**

Engine fails to start  
Porsche 928 S USA



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

- Visual examination:  
All hose lines correctly connected, not kinked or damaged?
- Leak test:  
  
Air-intake system checked for leaks with 0.3 bar gauge pressure?

no

yes

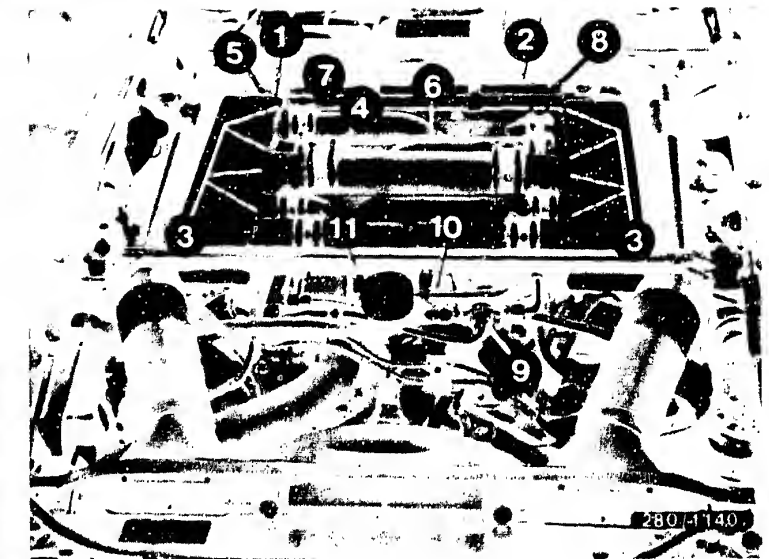
Continued on G19/G20

- Visual examination:  
Check whether hoses of air-intake system and of fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by re-tightening the connecting screws.
- Leak test:  
Preparations:
  - Remove left-hand and right-hand air-intake hoses.
  - Loosen rubber bands on air filter and lift off top part of air filter.
  - Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
  - Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
  - Remove bottom part of housing with hot-wire air-mass sensor.

Warning: Remove air-filter housing bottom part and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring in fitting or O-ring (dust protection on hot-wire air-mass sensor).

  - Loosen hot-wire air-mass sensor from bottom part of air-filter housing (note installation position-accessibility of adjusting screw) and seal the air-inlet opening e.g. with dust-protection cover from pack).
  - Re-mount bottom part of air-filter housing on hot-wire air-mass sensor.
  - Disconnect both hoses from idle actuator and seal tight the hose to the inlet manifold.
  - Mount bottom part of air-filter housing with the 2 hexagon screws A/F 10.

Continued on G19/G20



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

yes

Trouble-shooting program  
completed for customer  
complaint

"Starting motor operates,  
engine fails to start or  
starts only with great  
difficulty".

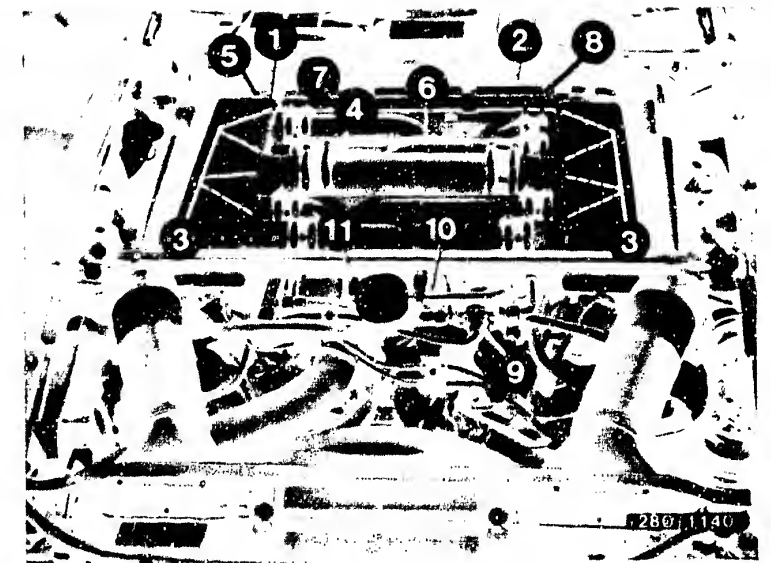
Fault eliminated?

- Testing
  - Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
  - Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:
  - Oil dipstick not securely inserted.
  - Defective cap seal on oil filler neck.
  - O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
  - Bubbling or foaming indicates a leak.
- Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover.  
Re-establish the original condition.

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C3).  
If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

**G 19**

Engine fails to start  
Porsche 928 S USA



**G 20**

Engine fails to start  
Porsche 928 S USA



## ENGINE STARTS BUT THEN DIES

Trouble-shooting program according to customer complaint

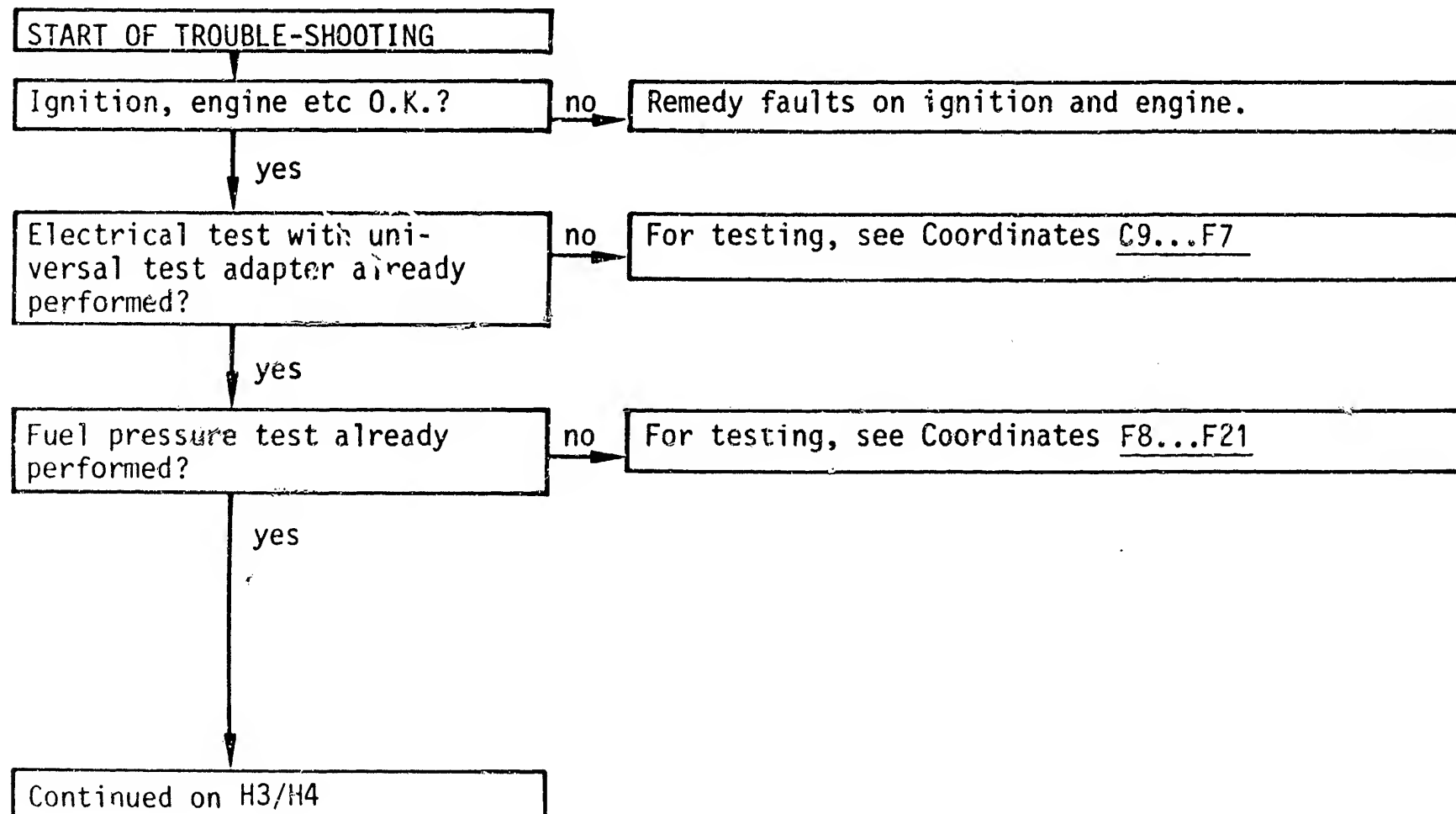
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



H1

Engine starts but then dies  
Porsche 928 S USA



H2

Engine starts but then dies  
Porsche 928 S USA



Engine starts but then dies (continued)

yes

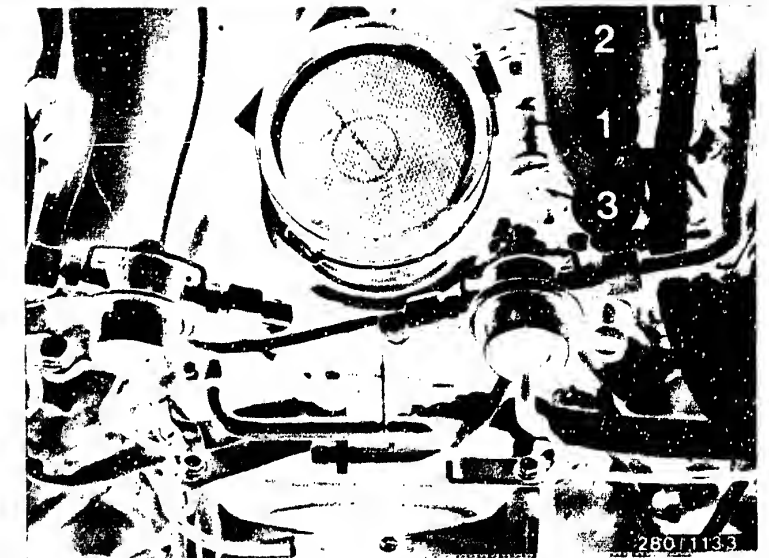
Idle actuator mechanically  
O.K.?

no

yes

Continued on H5/H6

- The idle actuator is checked for correct electrical operation with the universal test adapter.
- Mechanical test
- Removal of hot-wire air-mass sensor
- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition).
- Remove housing bottom part.
- Warning: Remove bottom part of air filter housing and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection). Disconnect plug.
- Removal of idle actuator
- The idle actuator is checked for freedom of movement as follows:
  - Remove idle actuator (disconnect hoses).
  - Disconnect plug. Connect center connection (term. 2) to battery voltage.
  - Connect outer connection (term. 1) to ground.
  - Visually examine whether the rotary slider turns to the limit stop.
  - Change over outer connection, i.e. connect term. 3 to ground. Rotary slider must now turn to opposite stop.
- Replace idle actuator if defective.
- When installing the idle actuator, pay attention to its direction of flow (arrow).
- Re-establish the original condition.



- 1 = Idle actuator  
2 = Connecting hoses  
3 = Plug

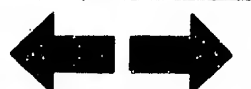
H3

Engine starts but then dies  
Porsche 928 S USA



H4

Engine starts but then dies  
Porsche 928 S USA





Engine starts but then dies (continued)

yes

Hot-wire air-mass sensor  
mechanically and elec-  
trically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?  
Between term. 6 and term. 3:  
 $0 \dots 1100 \Omega$   
Between term. 5 and term. 3:  
 $3.6 \dots 4.1 \Omega$

no

yes

Continued on H9/H10

#### Removal

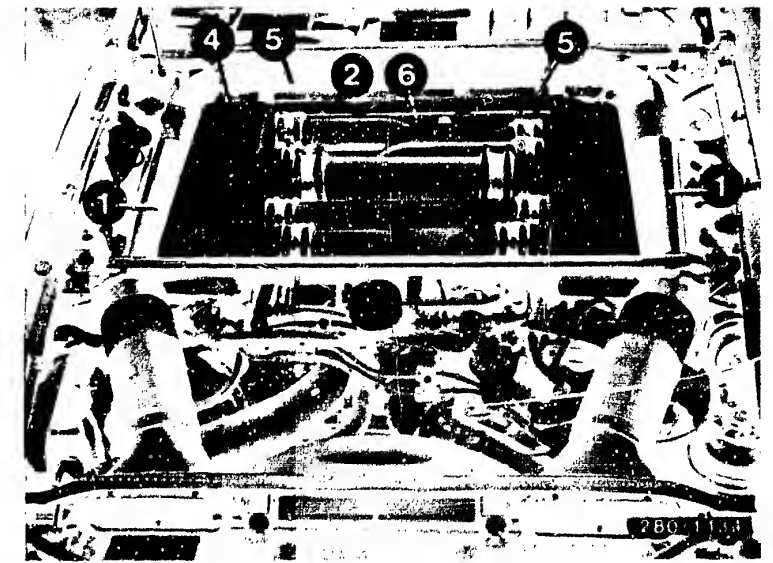
- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

Warning: Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).  
Disconnect plug.

#### Visual examination

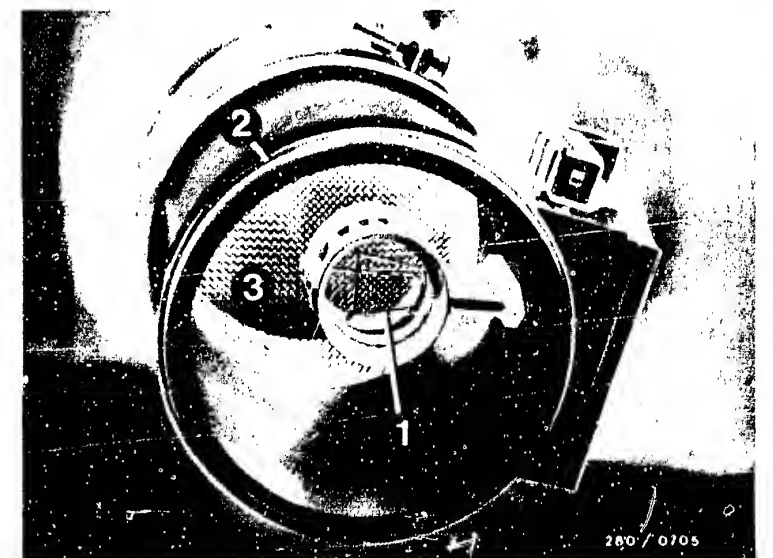
- Plug correctly connected.
- Spring retainer snapped in position.
- Plug not turned round.
- No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
- Wire screen O.K. on both sides?  
If hot wire broken - replace hot-wire air-mass sensor.

Continued on H7/H8



- 1 = Intake hose
- 2 = Air-filter housing top part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor

- 1 = Hot wire
- 2 = O-ring (dust protection)
- 3 = Wire screen



H5

Engine starts but then dies  
Porsche 928 S USA



H6

Engine starts but then dies  
Porsche 928 S USA





Engine starts but then dies (continued)

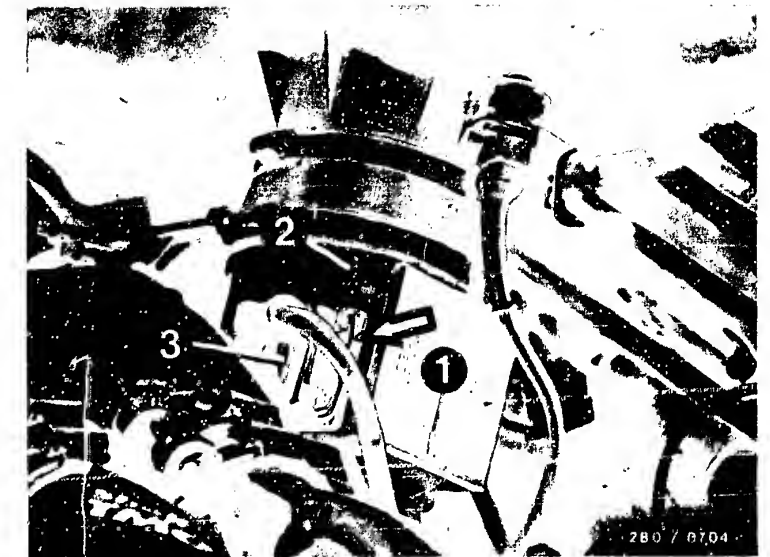
yes

• Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.  
Resistance measurement  
between term. 6 and term. 3:  
 $0...1100 \Omega$   
between term. 5 and term. 3:  
 $3.6...4.1 \Omega$   
If incorrect, replace hot-wire air-mass sensor.

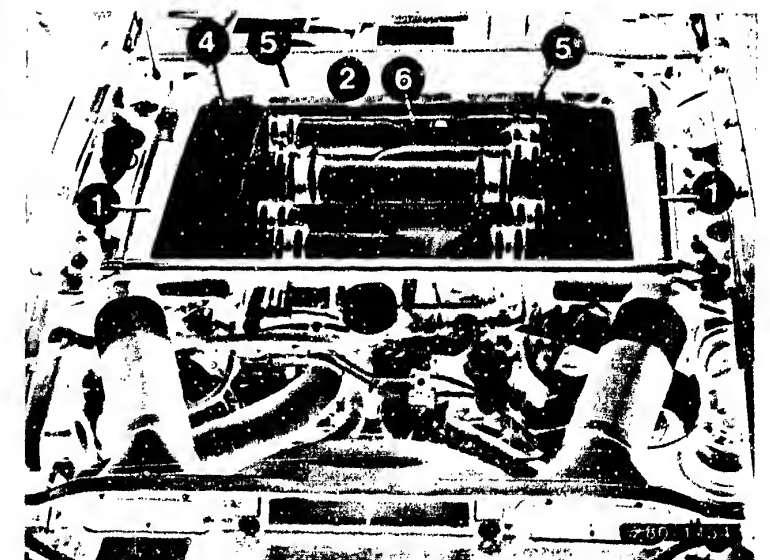
Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.



- 1 = Hot-wire air-mass sensor
- 3 = Plug  
Press retainer in direction of arrow when disconnecting plug

- 1 = Intake hose
- 2 = Air-filter housing top part
- 3 = Air-filter housing bottom part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor



Continued on H9/H10

**H7**

Engine starts but then dies

Porsche 928 S USA



**H8**

Engine starts but then dies

Porsche 928 S USA



Engine starts but then dies (continued)

yes

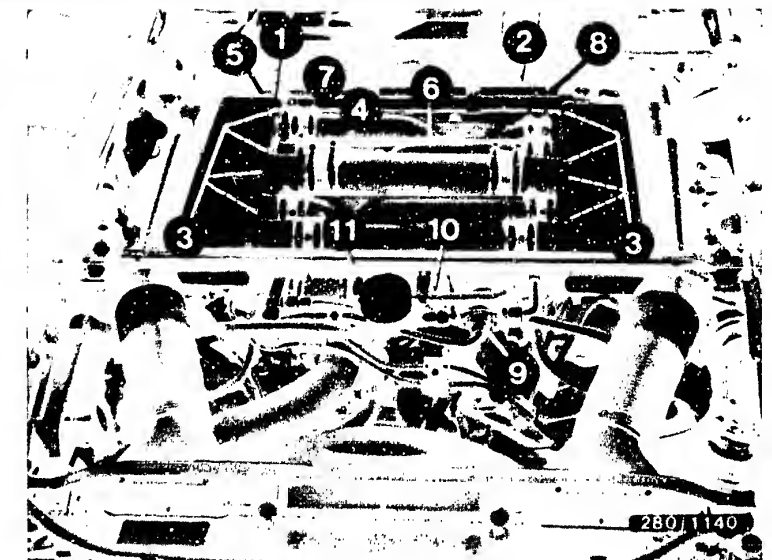
Solenoid-operated injection valves leak-tight?

no

- Leak test on injection valves
- Remove fuel-distribution pipes with injection valves (remove intake-air distributors left/right). Loosen fastening screws on fuel-distribution pipe and injection valves. Remove all 8 injection valves simultaneously and carefully from the cylinder head. Build up fuel pressure: Jump safety circuit.  
Caution: Make sure that no fuel gets onto hot parts of the engine.  
Test specification:  
Within 60 sec. no drop may fall from the mouth of the injection valve. Otherwise replace injection valve.
- Removal
  - Disconnect electrical connection.
  - Carefully remove holding clamp from groove.
  - Carefully remove injection valve from fuel-distribution pipe.Caution: Catch escaping fuel. Do not allow to drip onto hot parts of the engine.  
Warning: Before installing, the two O-rings must be greased only lightly (silicone grease Ft 2 v 1). The other parts of the injection valves must remain free of grease.
- Installation: Connect new injection valve carefully to fuel-distribution pipe.
  - Slide holding clamp into groove until it latches (check O-rings for leaks).Caution: After testing the injection valves and the fuel-distribution pipes, re-establish the original condition of installation. Check for leaks (unmetered air).

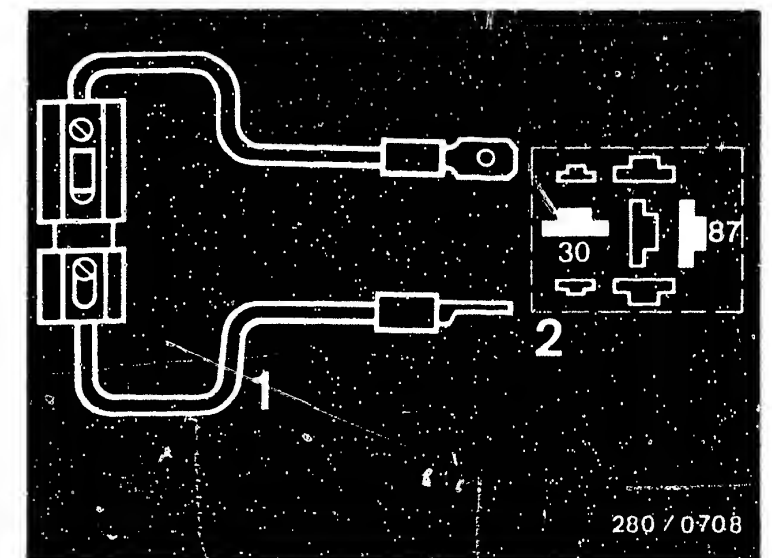
yes

Continued on H11/H12



3 = Injection valves

1 = Jumper with fuse holder and  
10 A fuse (user-fabricated)  
2 = Top view of connection base



H9

Engine starts but then dies  
Porsche 928 S USA



H10

Engine starts but then dies  
Porsche 928 S USA



# Engine starts but then dies (continued)

yes

- Visual examination:  
All hose lines correctly connected, not kinked or damaged?
- Leak test:  
  
Air-intake system checked for leaks with 0.3 bar gauge pressure?

no

yes

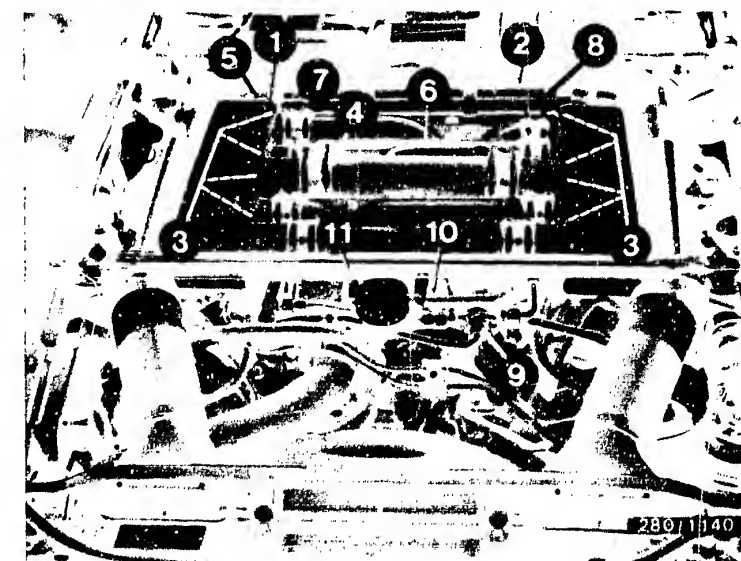
Continued on H13/H14

- Visual examination:  
Check whether hoses of air-intake system and of fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by re-tightening the connecting screws.
- Leak test:  
Preparations:
  - Remove left-hand and right-hand air-intake hoses.
  - Loosen rubber bands on air filter and lift off top part of air filter.
  - Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
  - Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
  - Remove bottom part of housing with hot-wire air-mass sensor.

Warning: Remove air-filter housing bottom part and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring in fitting or O-ring (dust protection on hot-wire air-mass sensor).

  - Loosen hot-wire air-mass sensor from bottom part of air-filter housing (note installation position-accessibility of adjusting screw) and seal the air-inlet opening e.g. with dust-protection cover from pack).
  - Re-mount bottom part of air-filter housing on hot-wire air-mass sensor.
  - Disconnect both hoses from idle actuator and seal tight the hose to the inlet manifold.
  - Mount bottom part of air-filter housing with the 2 hexagon screws A/F 10.

Continued on H13/H14



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

H11

Engine starts but then dies  
Porsche 928 S USA



H12

Engine starts but then dies  
Porsche 928 S USA



# Engine starts but then dies (continued)

yes

Trouble-shooting program  
completed for customer  
complaint

"Engine starts but then dies".

Fault eliminated?

no

## • Testing

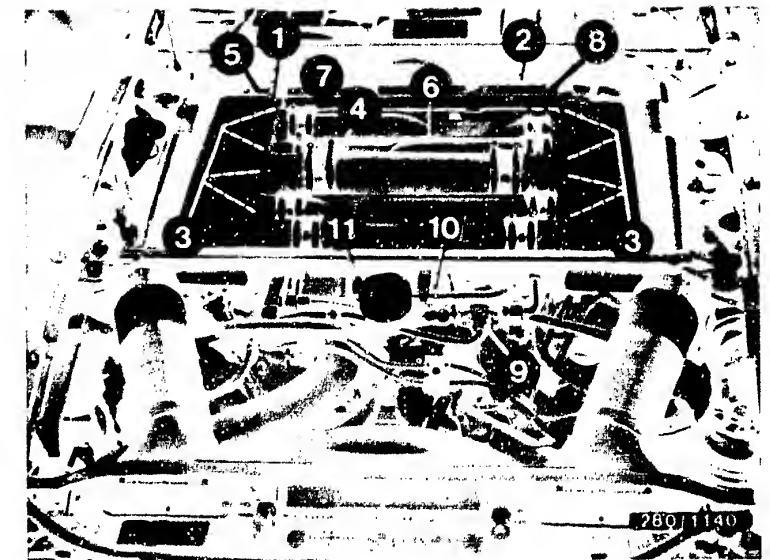
- Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
- Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:
- Oil dipstick not securely inserted.
- Defective cap seal on oil filler neck.
- O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
- Bubbling or foaming indicates a leak.

## • Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover. Re-establish the original condition.

## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

H13

Engine starts but then dies  
Porsche 928 S USA



H14

Engine starts but then dies  
Porsche 928 S USA



## ROUGH IDLE; INCORRECT IDLE SPEED

Trouble-shooting program according to customer complaint.

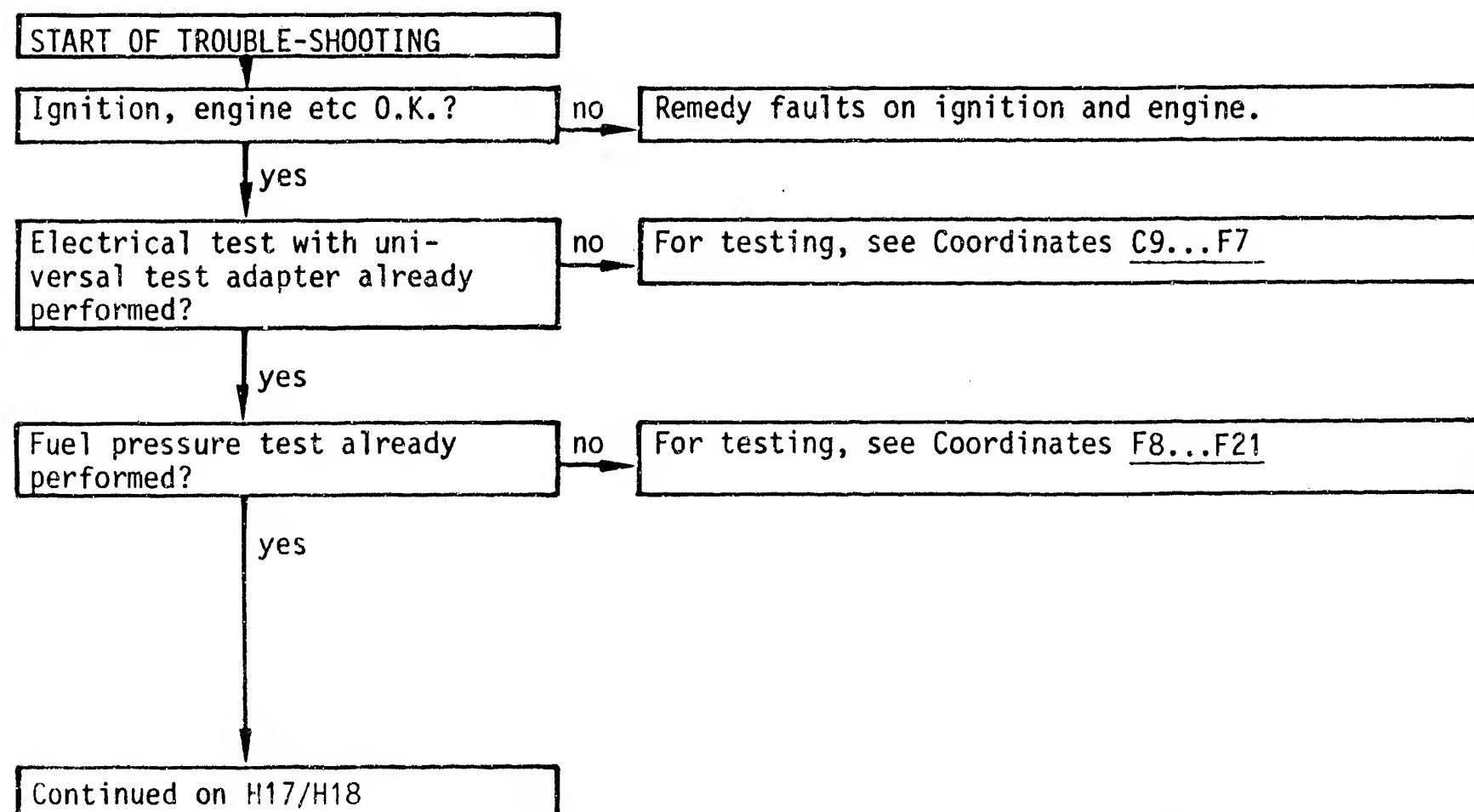
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**H 15**

Rough idle  
Porsche 928 S USA



**H 16**

Rough idle  
Porsche 928 S USA





Rough idle, incorrect idle speed (continued)

yes

Throttle valve closed?

- Throttle lever up against stop screw?
- Throttle cable free of tension?
- Throttle cable not kinked?

no

• Testing

Remove air-intake system. Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

• Adjusting the throttle valve:

The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

- If throttle cable kinked - replace. Re-establish original condition of installation.

yes

Throttle-valve switch correctly adjusted?

- Idle contact closing?
- Microswitch clicking audibly?

no

• Adjusting the throttle-valve switch

Remove air-intake system. Slightly loosen fastening screws of throttle-valve switch. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch to the left until the idle contact closes (microswitch clicks audibly). Reading 0  $\Omega$ .

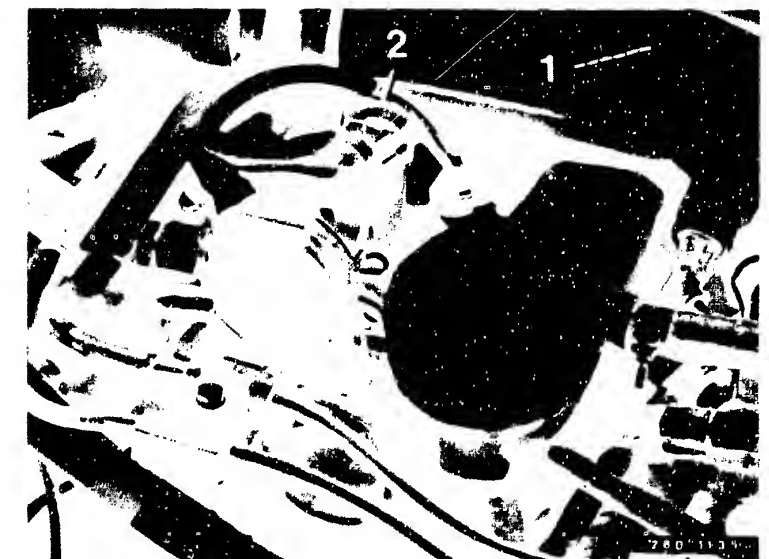
• Checking the adjustment:

Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading  $\infty \Omega$ .

Re-establish original condition of installation.

yes

Continued on H19/H20



- 1 = Throttle-valve switch  
2 = Adapter plug for throttle-valve switch connecting lead /Extension)

**H17**

Rough idle  
Porsche 928 S USA



**H18**

Rough idle  
Porsche 928 S USA





Rough idle, incorrect idle speed (continued)

yes

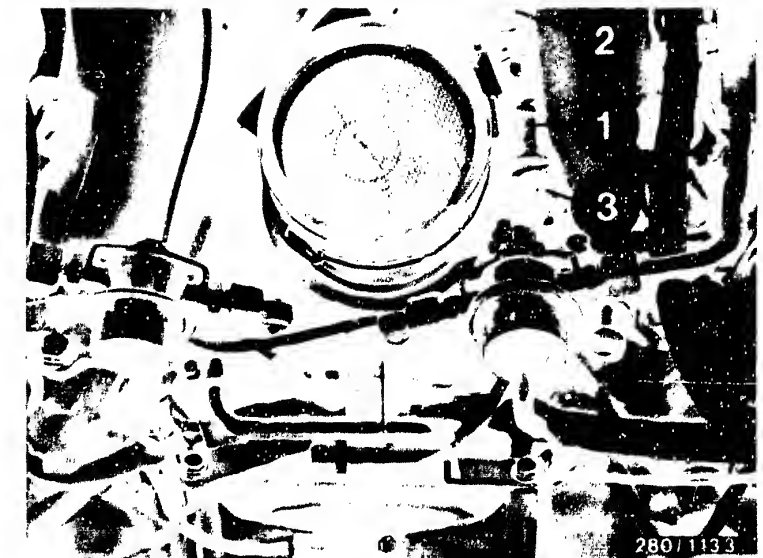
Idle actuator mechanically  
O.K.?

no

- The idle actuator is checked for correct electrical operation with the universal test adapter.
- Mechanical test
- Removal of hot-wire air-mass sensor
- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition).
- Remove housing bottom part.
- Warning: Remove bottom part of air filter housing and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection). Disconnect plug.
- Removal of idle actuator
- The idle actuator is checked for freedom of movement as follows:
  - Remove idle actuator (disconnect hoses).
  - Disconnect plug. Connect center connection (term. 2) to battery voltage.
  - Connect outer connection (term. 1) to ground.
  - Visually examine whether the rotary slider turns to the limit stop.
  - Change over outer connection, i.e. connect term. 3 to ground. Rotary slider must now turn to opposite stop.
- Replace idle actuator if defective.
- When installing the idle actuator, pay attention to its direction of flow (arrow).
- Re-establish the original condition.

yes

Continued on H21/H22



- 1 = Idle actuator  
2 = Connecting hoses  
3 = Plug

H19

Rough idle  
Porsche 928 S USA



H20

Rough idle  
Porsche 928 S USA



## Rough idle, incorrect idle speed (continued)

yes

Injection valves checked for proper operation?

- Diagram shown opposite visible on oscilloscope?
- No deviation or missing or interference detectable?

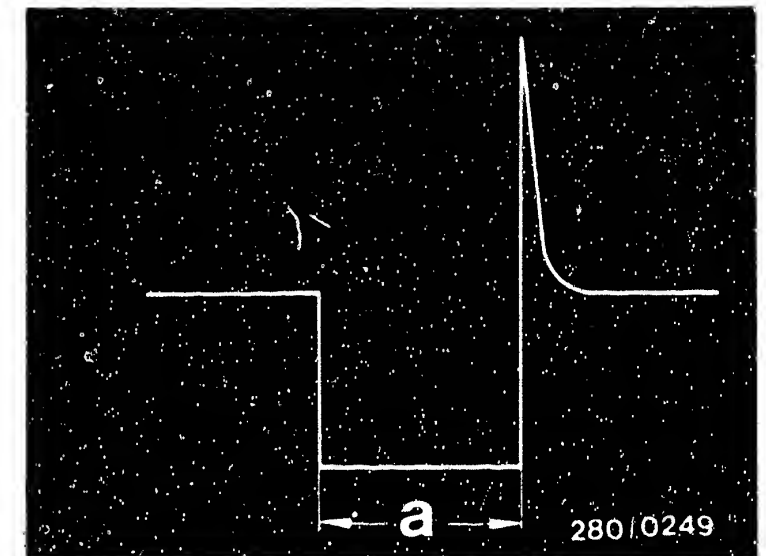
no

### Functional test of injection valves

- **Connect test lead as follows:**  
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one need be connected to the special input of the motortester.
- **Caution:**  
The unoccupied terminal must not come into contact with the bodywork.
- If correctly connected, the pattern shown opposite is visible on the oscilloscope. With the aid of the test lead it is possible to test the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if deviations (interference, missing etc) are visible, the other injection valves should also be tested.
- In case of interference: Check routing of leads.
- In case of missing: Eliminate loose contacts in the leads or in the plug-in connections.

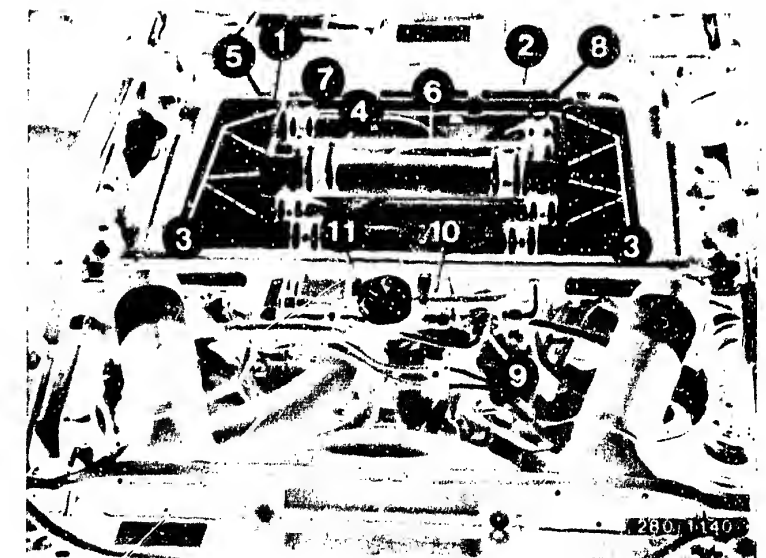
yes

Continued on H23/H24



Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load).

3 = Injection valves



**H21**

Rough idle

Porsche 928 S USA



**H22**

Rough idle

Porsche 928 S USA



## Rough idle, incorrect idle speed (continued)

yes

Injection valves O.K.?

• Removal and installation

no

yes

Continued on J1/J2

### • Removal

Remove fuel-distribution pipes with injection valves.

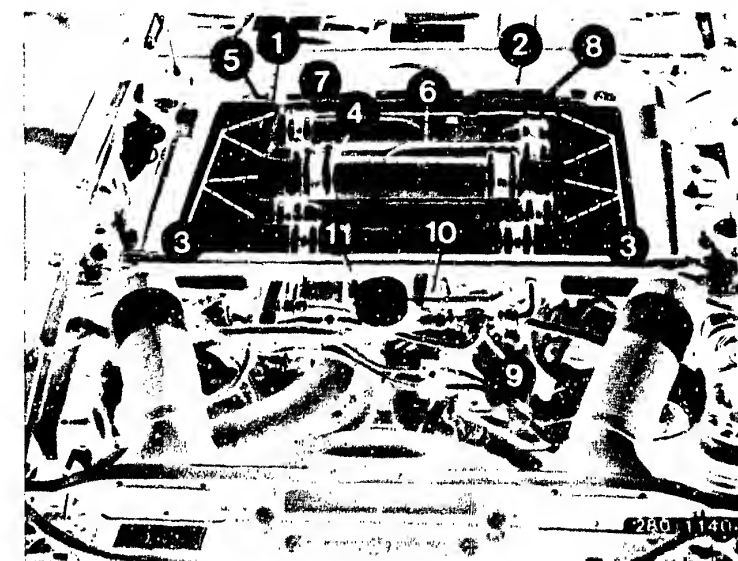
- Remove air-intake hoses, air filter with top and bottom parts (with hot-wire air-mass sensor).
  - Remove air-intake system left/right.
  - Loosen fastening screws on fuel-distribution pipe and on injection valves.
  - Loosen strut.
  - Pull all 8/4 injection valves simultaneously and carefully out of the cylinder.
- If injection valves defective on one side, loosen fuel-distribution pipe at pressure regulator.
- Caution: Make sure that no fuel gets onto hot parts of the engine.
- Pull off electrical connection.
  - Carefully slide holding clamp out of groove.
  - Carefully remove injection valve from fuel-distribution pipe.

Caution: Do not allow escaping fuel to drip onto hot parts of the engine.

Warning: Before installation, the O-rings must be greased only lightly (silicone grease FT 2 v 1). The other parts must remain free of grease.

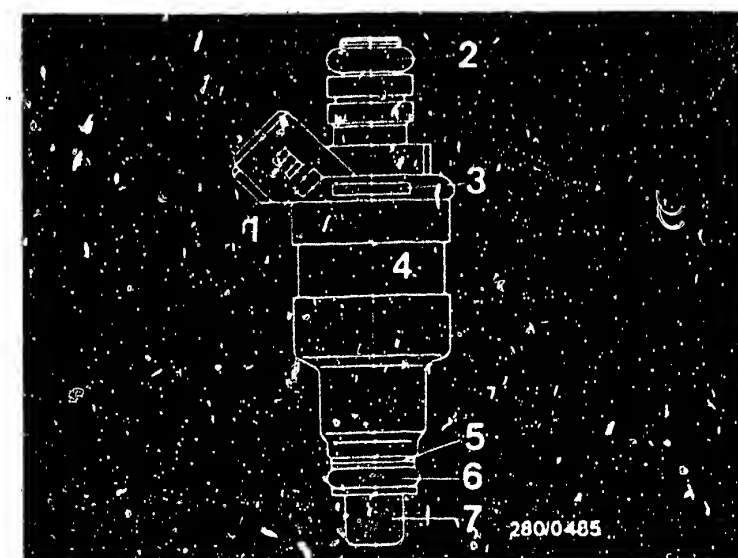
### • Installation

- Carefully connect new solenoid-operated injection valve to fuel-distribution pipe.
- Slide holding clamp into groove until it latches (check O-rings for leaks). Ensure that the original condition of installation is re-established.



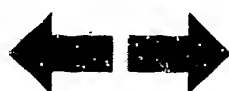
3 = Injection valves

- 1 = FD mark
- 2 = Upper O-ring
- 3 = Part number
- 4 = Injection valve
- 5 = Supporting plate
- 6 = Lower O-ring
- 7 = Protective sleeve



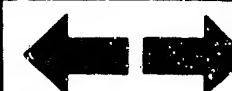
H23

Rough idle  
Porsche 928 S USA



H24

Rough idle  
Porsche 928 S USA



# Rough idle, incorrect idle speed (continued)

yes

- Visual examination:  
All hose lines correctly connected, not kinked or damaged?
- Leak test:  
  
Air-intake system checked for leaks with 0.3 bar gauge pressure?

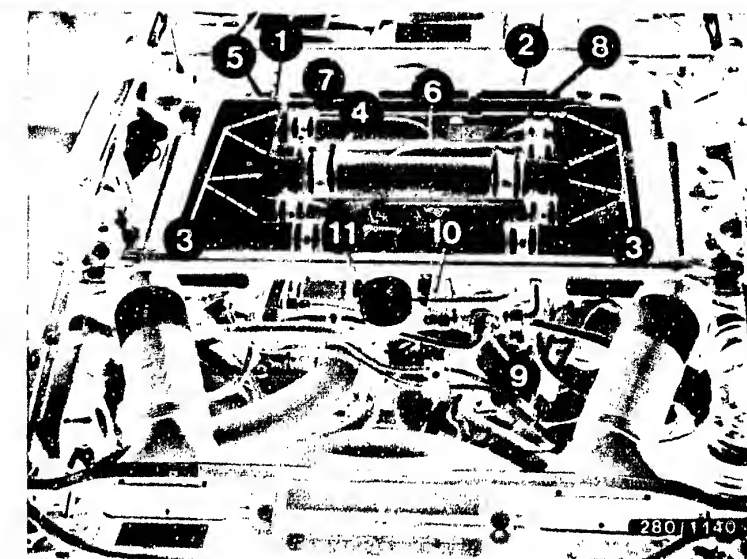
no

yes

Continued on J3/J4

- Visual examination:  
Check whether hoses of air-intake system and of fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by re-tightening the connecting screws.
- Leak test:  
Preparations:
  - Remove left-hand and right-hand air-intake hoses.
  - Loosen rubber bands on air filter and lift off top part of air filter.
  - Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
  - Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
  - Remove bottom part of housing with hot-wire air-mass sensor.Warning: Remove air-filter housing bottom part and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring in fitting or O-ring (dust protection on hot-wire air-mass sensor).
  - Loosen hot-wire air-mass sensor from bottom part of air-filter housing (note installation position-accessibility of adjusting screw) and seal the air-inlet opening e.g. with dust-protection cover from pack).
  - Re-mount bottom part of air-filter housing on hot-wire air-mass sensor.
  - Disconnect both hoses from idle actuator and seal tight the hose to the inlet manifold.
  - Mount bottom part of air-filter housing with the 2 hexagon screws A/F 10.

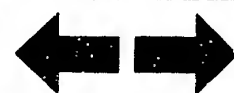
Continued on J3/J4



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

J1

Rough idle  
Porsche 928 S USA



J2

Rough idle  
Porsche 928 S USA



# Rough idle, incorrect idle speed (continued)

yes

Trouble-shooting program  
completed for customer  
complaint

"Rough idle, incorrect  
idle speed".

Fault eliminated?

no

## • Testing

- Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
- Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:

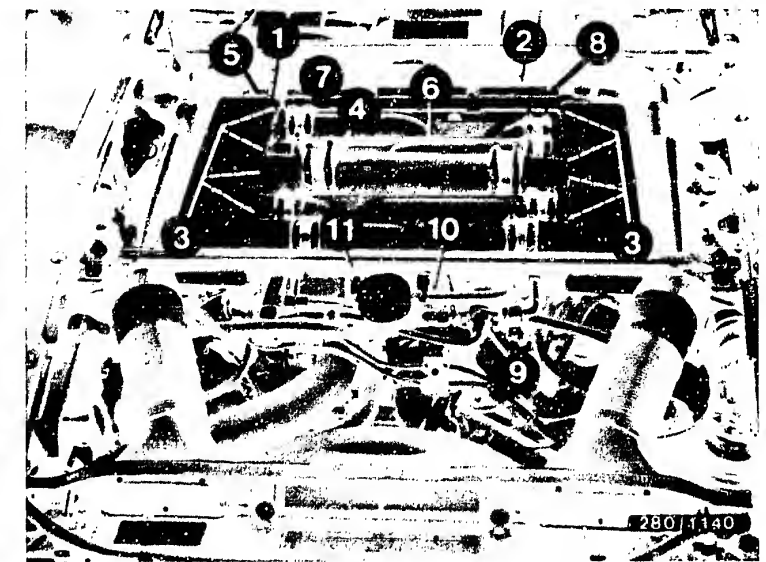
- Oil dipstick not securely inserted.
- Defective cap seal on oil filler neck.
- O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
- Bubbling or foaming indicates a leak.

## • Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover. Re-establish the original condition.

## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

J3

Rough idle

Porsche 928 S USA



J4

Rough idle

Porsche 928 S USA





## POOR THROTTLE TAKE-UP

Trouble-shooting program according to customer complaint

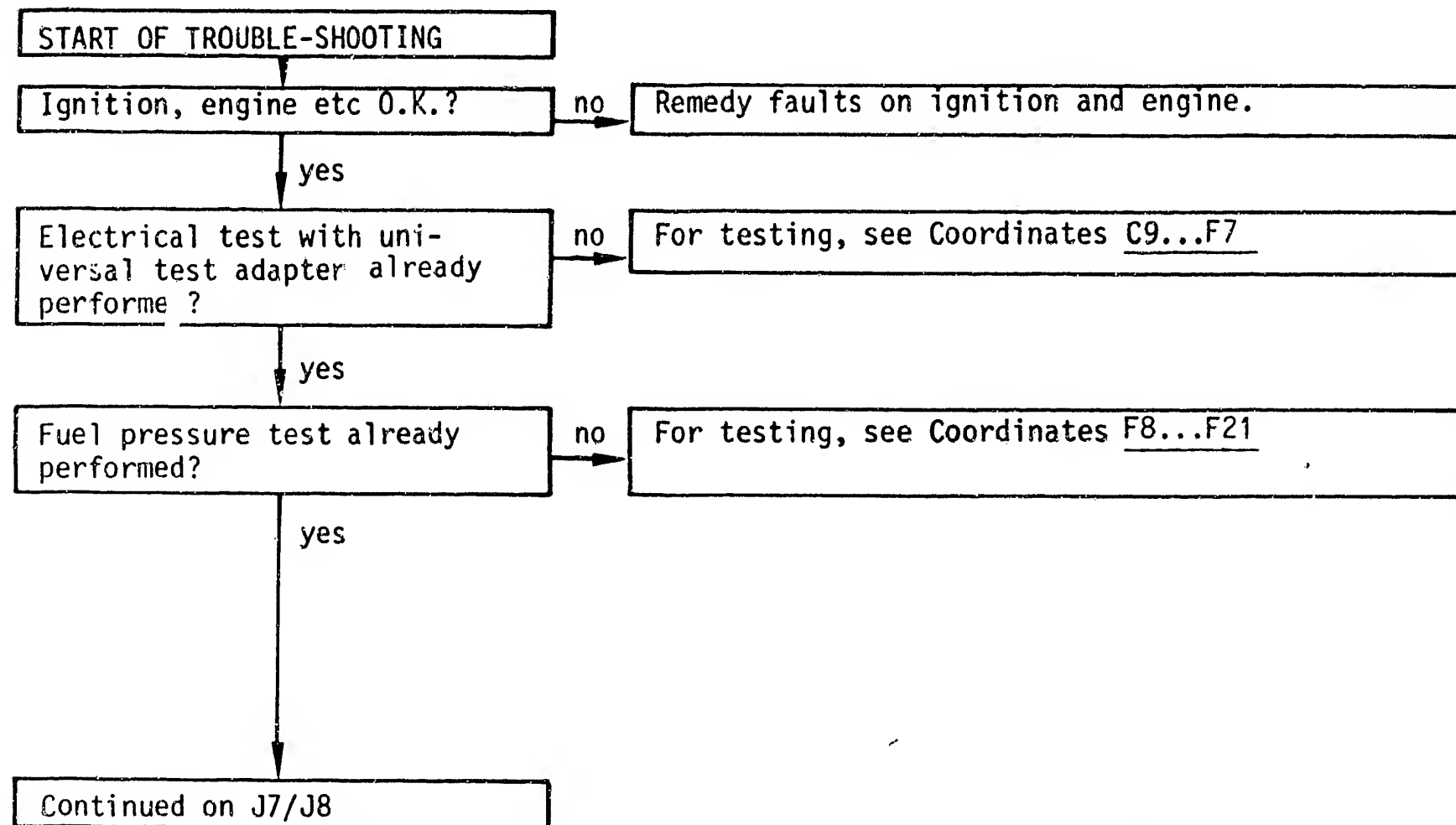
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**J5**

Poor throttle take-up  
Porsche 928 S USA



**J6**

Poor throttle take-up  
Porsche 928 S USA





# Poor throttle take-up (continued)

yes

Throttle valve closed?

- Throttle lever up against stop screw?
- Throttle cable free of tension?
- Throttle cable not kinked?

no

## • Testing

Remove air-intake system. Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

## • Adjusting the throttle valve:

The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

- If throttle cable kinked - replace. Re-establish original condition of installation.

yes

Throttle-valve switch correctly adjusted?

- Idle contact closing?
- Microswitch clicking audibly?

no

## • Adjusting the throttle-valve switch

Remove air-intake system. Slightly loosen fastening screws of throttle-valve switch. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch to the left until the idle contact closes (microswitch clicks audibly). Reading 0  $\Omega$ .

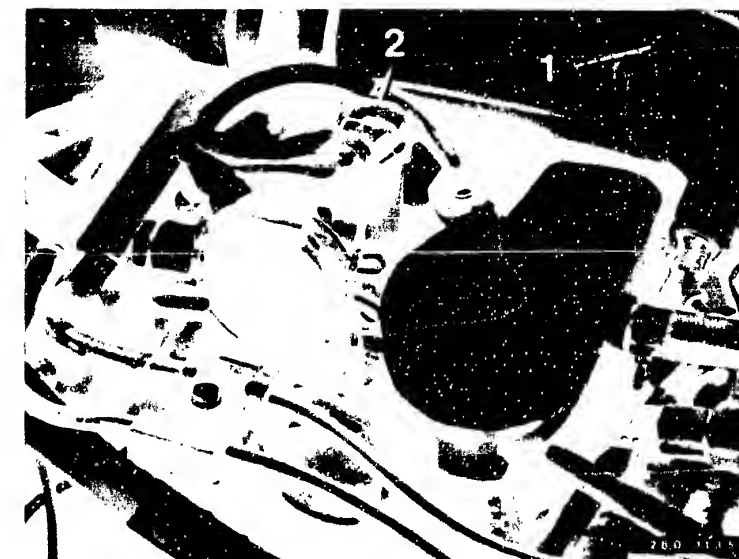
## • Checking the adjustment:

Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading  $\infty \Omega$ .

Re-establish original condition of installation.

yes

Continued on J9/J10



- 1 = Throttle-valve switch
- 2 = Adapter plug for throttle-valve switch connecting lead /Extension)

**J7**

Poor throttle take-up  
Porsche 928 S USA



**J8**

Poor throttle take-up  
Porsche 928 S USA



Poor throttle take-up (continued)

yes

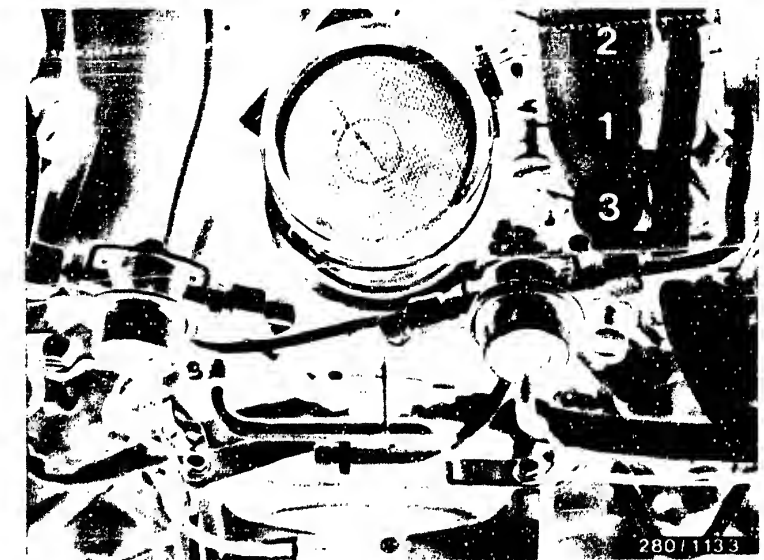
Idle actuator mechanically  
O.K.?

no

yes

Continued on J11/J12

- The idle actuator is checked for correct electrical operation with the universal test adapter.
- Mechanical test  
Removal of hot-wire air-mass sensor
- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition).
- Remove housing bottom part.
- Warning: Remove bottom part of air filter housing and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection). Disconnect plug.
- Removal of idle actuator  
The idle actuator is checked for freedom of movement as follows:
  - Remove idle actuator (disconnect hoses).
  - Disconnect plug. Connect center connection (term. 2) to battery voltage.
  - Connect outer connection (term. 1) to ground.
  - Visually examine whether the rotary slider turns to the limit stop.
  - Change over outer connection, i.e. connect term. 3 to ground. Rotary slider must now turn to opposite stop.Replace idle actuator if defective.  
When installing the idle actuator, pay attention to its direction of flow (arrow).
- Re-establish the original condition.



- 1 = Idle actuator  
2 = Connecting hoses  
3 = Plug

**J9**

Poor throttle take-up  
Porsche 928 S USA



**J10**

Poor throttle take-up  
Porsche 928 S USA



# Poor throttle take-up (continued)

yes

Hot-wire air-mass sensor  
mechanically and elec-  
trically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?

Between term. 6 and term. 3:  
0...1100  $\Omega$

Between term. 5 and term. 3:  
3.6...4.1  $\Omega$

no

yes

Continued on J15/J16

## Removal

- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

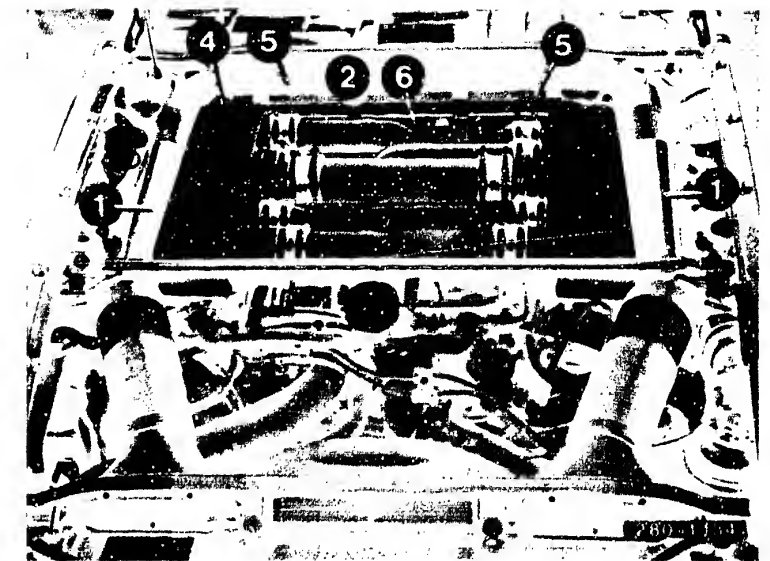
**Warning:** Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).

Disconnect plug.

## Visual examination

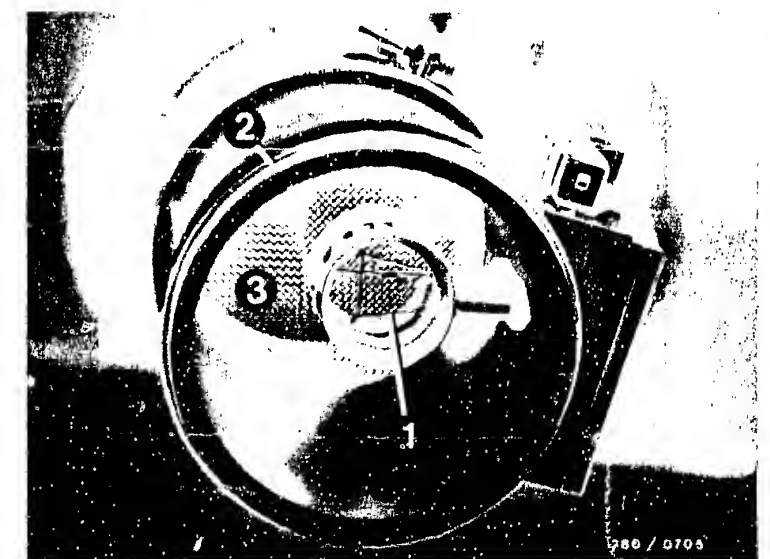
- Plug correctly connected.
  - Spring retainer snapped in position.
  - Plug not turned round.
  - No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
  - Wire screen O.K. on both sides?
- If hot wire broken - replace hot-wire air-mass sensor.

Continued on J13/J14



- 1 = Intake hose
- 2 = Air-filter housing top part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor

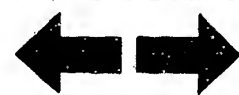
- 1 = Hot wire
- 2 = O-ring (dust protection)
- 3 = Wire screen



**J11**

Poor throttle take-up

Porsche 928 S USA



**J12**

Poor throttle take-up

Porsche 928 S USA



Poor throttle take-up (continued)

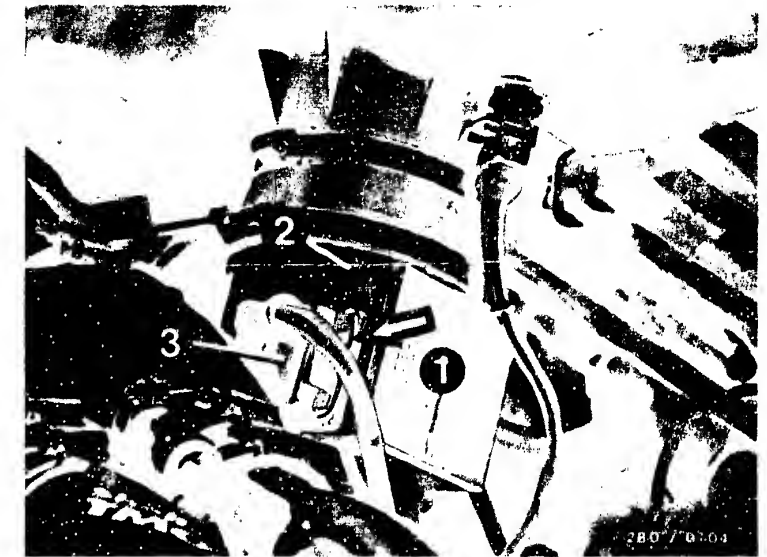
yes

● Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.  
Resistance measurement  
between term. 6 and term. 3:  
 $0...1100 \Omega$   
between term. 5 and term. 3:  
 $3.6...4.1 \Omega$   
If incorrect, replace hot-wire air-mass sensor.

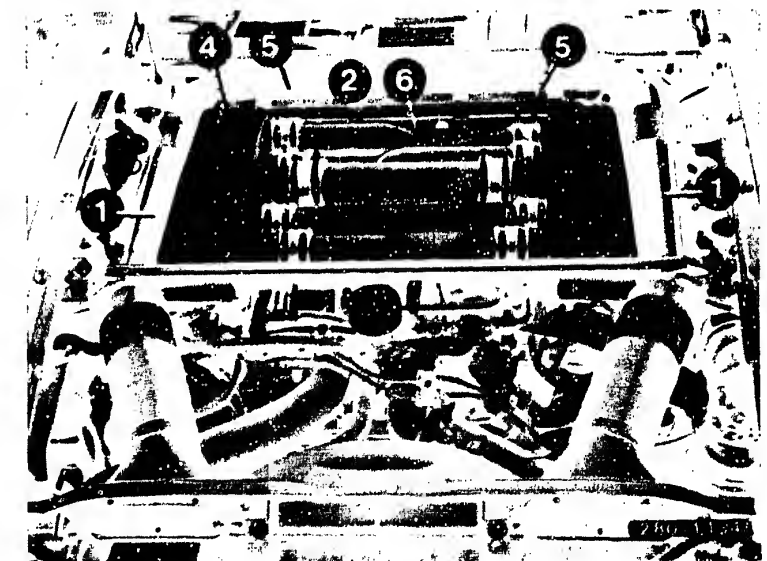
Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.



- 1 = Hot-wire air-mass sensor  
3 = Plug  
Press retainer in direction of arrow when disconnecting plug

- 1 = Intake hose  
2 = Air-filter housing top part  
3 = Air-filter housing bottom part  
4 = Hose to blow-off change-over valve  
5 = Hexagon screws  
6 = Hot-wire air-mass sensor



Continued on J15/J16

**J13**

Poor throttle take-up  
Porsche 928 S USA



**J14**

Poor throttle take-up  
Porsche 928 S USA



# Poor throttle take-up (continued)

yes

- Visual examination:  
All hose lines correctly connected, not kinked or damaged?
- Leak test:  
  
Air-intake system checked for leaks with 0.3 bar gauge pressure?

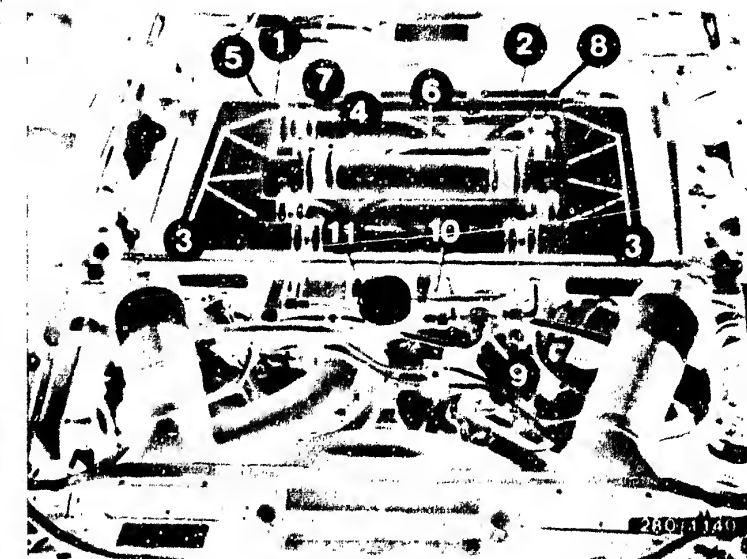
no

yes

Continued on J17/J18

- Visual examination:  
Check whether hoses of air-intake system and of fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by re-tightening the connecting screws.
- Leak test:  
Preparations:
  - Remove left-hand and right-hand air-intake hoses.
  - Loosen rubber bands on air filter and lift off top part of air filter.
  - Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
  - Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
  - Remove bottom part of housing with hot-wire air-mass sensor.Warning: Remove air-filter housing bottom part and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring in fitting or O-ring (dust protection on hot-wire air-mass sensor).
  - Loosen hot-wire air-mass sensor from bottom part of air-filter housing (note installation position-accessibility of adjusting screw) and seal the air-inlet opening e.g. with dust-protection cover from pack).
  - Re-mount bottom part of air-filter housing on hot-wire air-mass sensor.
  - Disconnect both hoses from idle actuator and seal tight the hose to the inlet manifold.
  - Mount bottom part of air-filter housing with the 2 hexagon screws A/F 10.

Continued on J17/J18



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

**J15**

Poor throttle take-up  
Porsche 928 S USA



**J16**

Poor throttle take-up  
Porsche 928 S USA





# Poor throttle take-up (continued)

yes

Trouble-shooting program  
completed for customer  
complaint

"Poor throttle take-up"

Fault eliminated?

no

## • Testing

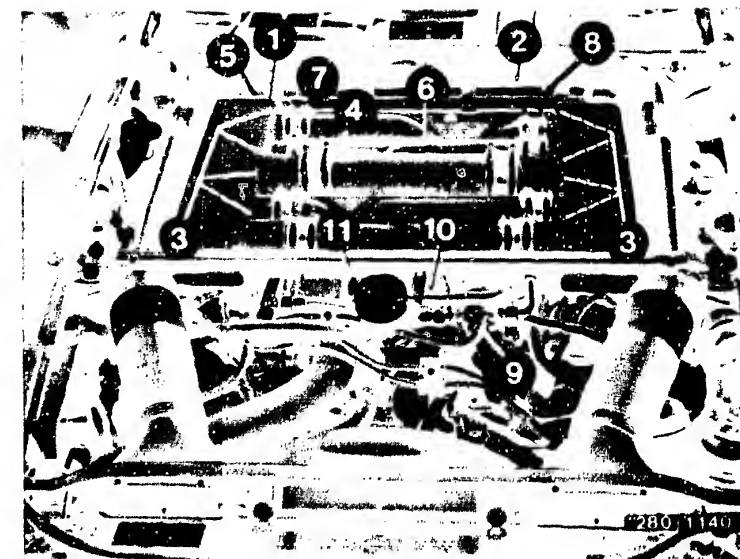
- Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
- Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:
- Oil dipstick not securely inserted.
- Defective cap seal on oil filler neck.
- O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
- Bubbling or foaming indicates a leak.

## • Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover. Re-establish the original condition.

## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

J17

Poor throttle take-up

Porsche 928 S USA



J18

Poor throttle take-up

Porsche 928 S USA





## ENGINE MISSING UNDER ALL OPERATING CONDITIONS

Trouble-shooting program according to customer complaint

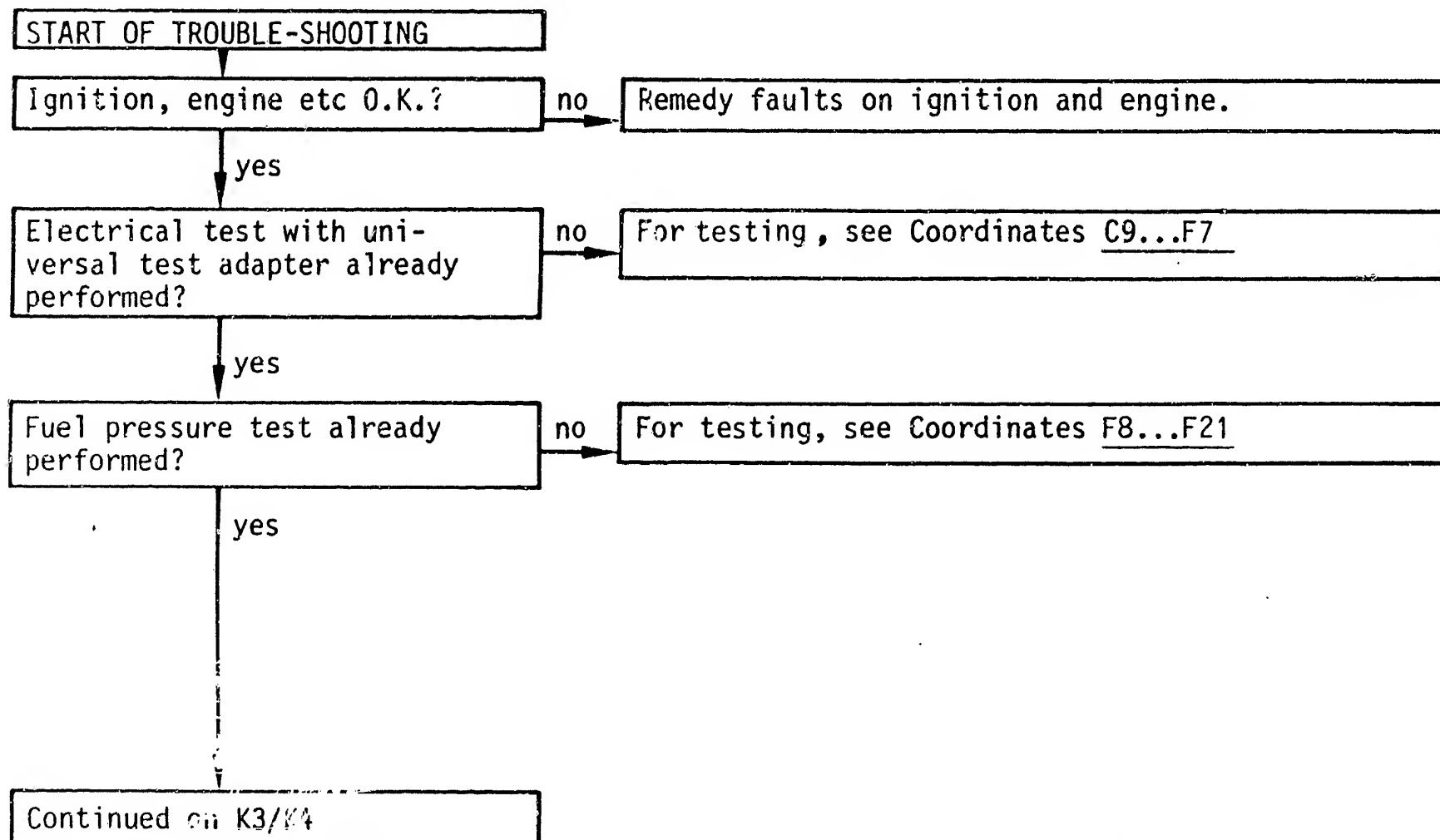
### Procedure

The test is divided into 3 rows of boxes:

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- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**K1**

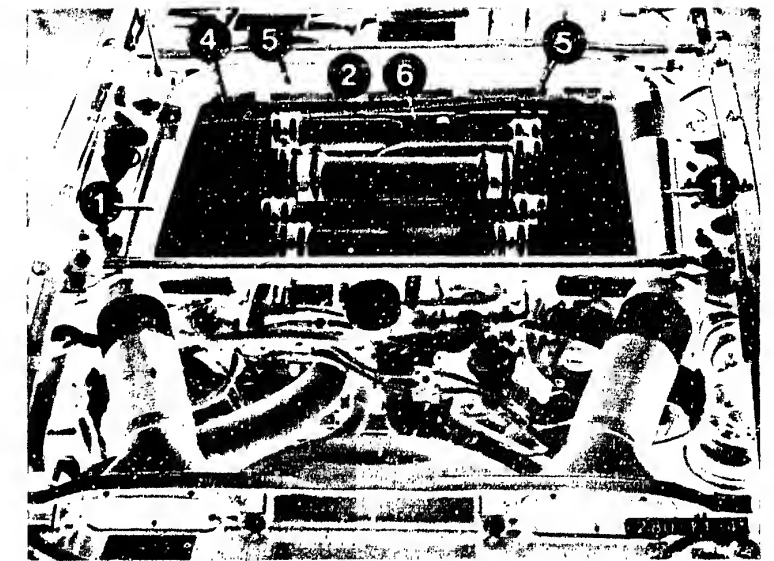
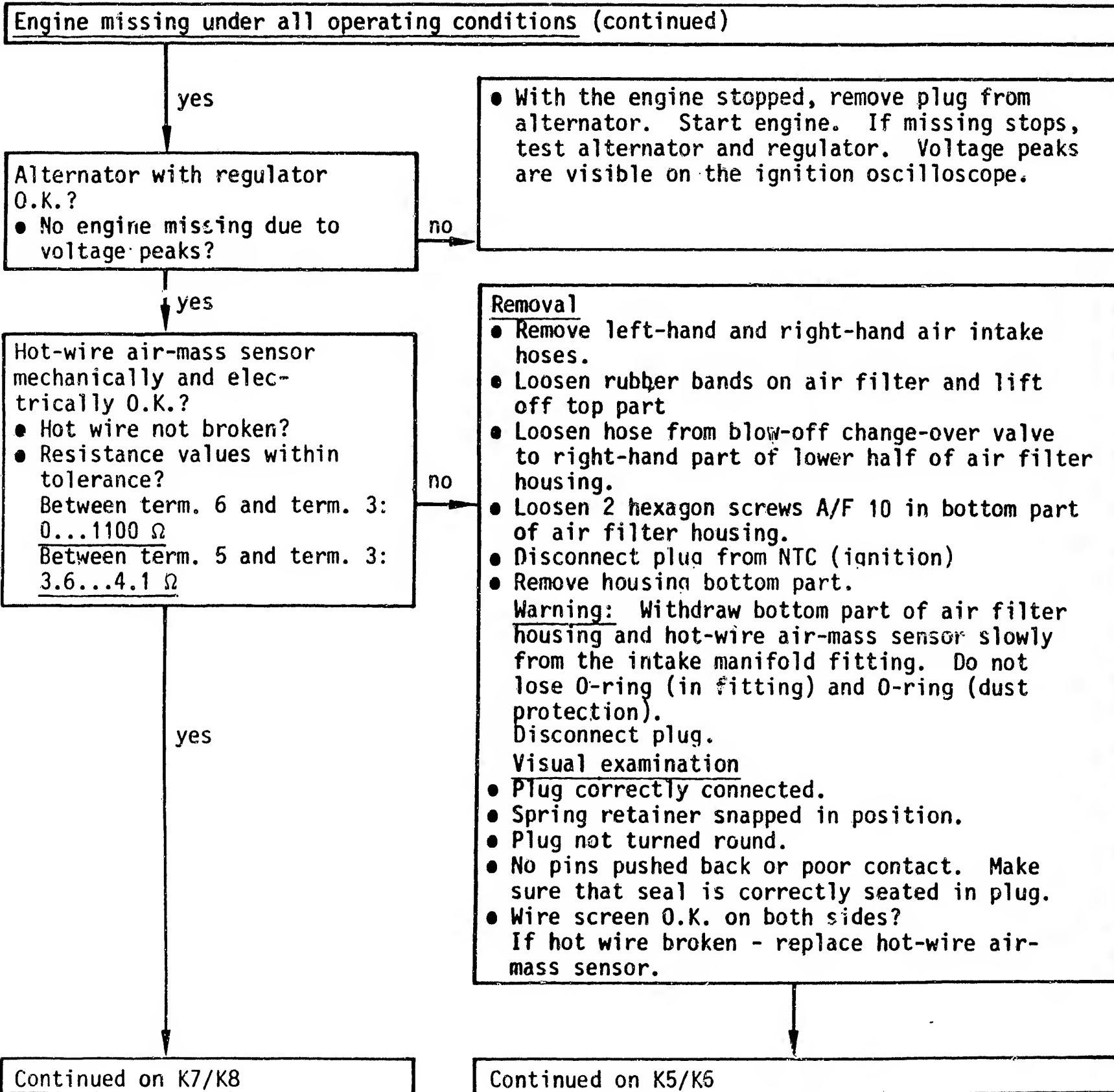
Engine missing under all op. conditions  
Porsche 928 S USA



**K2**

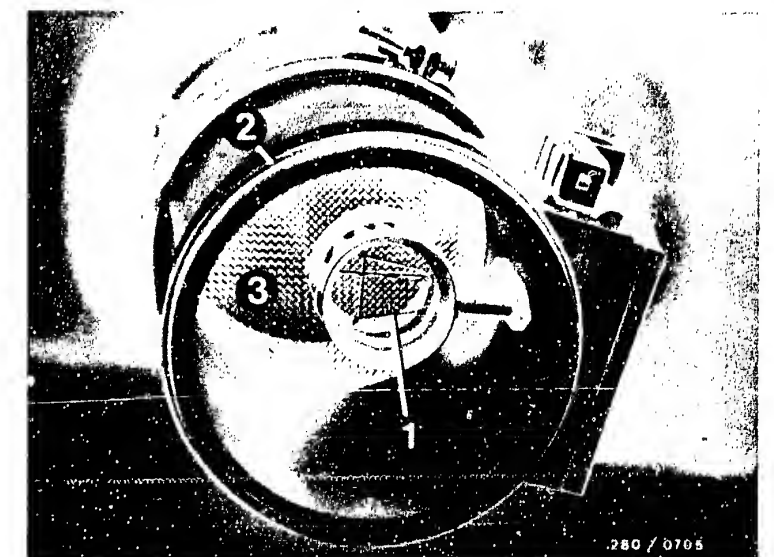
Engine missing under all op. conditions  
Porsche 928 S USA





- 1 = Intake hose  
2 = Air-filter housing top part  
4 = Hose to blow-off change-over valve  
5 = Hexagon screws  
6 = Hot-wire air-mass sensor

- 1 = Hot wire  
2 = O-ring (dust protection)  
3 = Wire screen



**K3**

Engine missing under all op. conditions  
Porsche 928 S USA



**K4**

Engine missing under all op. conditions  
Porsche 928 S USA



Engine missing under all operating conditions (continued)

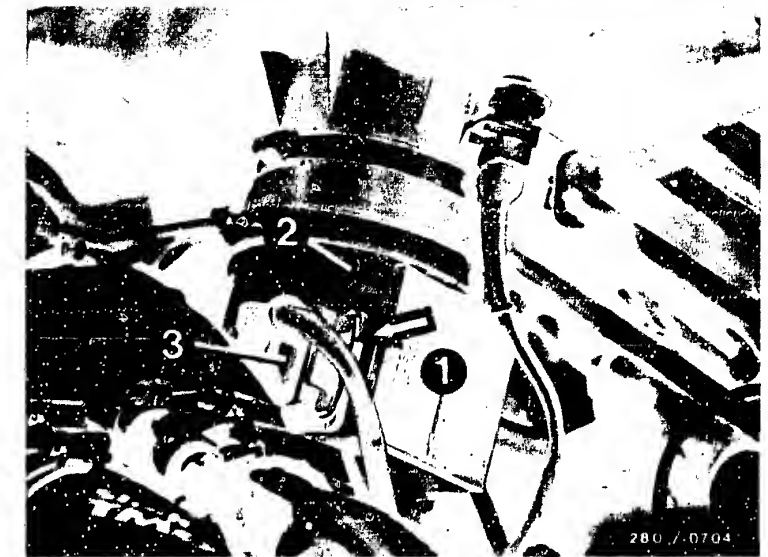
yes

• Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.  
Resistance measurement  
between term. 6 and term. 3:  
0...1100  $\Omega$   
between term. 5 and term. 3:  
3.6...4.1  $\Omega$   
If incorrect, replace hot-wire air-mass sensor.

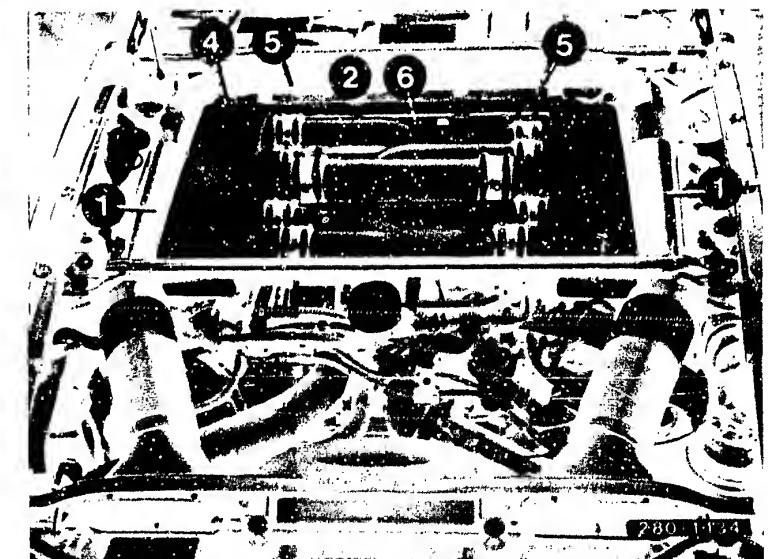
Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.



- 1 = Hot-wire air-mass sensor  
3 = Plug  
Press retainer in direction of arrow when disconnecting plug

- 1 = Intake hose  
2 = Air-filter housing top part  
3 = Air-filter housing bottom part  
4 = Hose to blow-off change-over valve  
5 = Hexagon screws  
6 = Hot-wire air-mass sensor



Continued on K7/K8

**K5**

Engine missing under all op. conditions  
Porsche 928 S USA



**K6**

Engine missing under all op. conditions  
Porsche 928 S USA



Engine missing under all operating conditions (continued)

yes

Fuel delivery of electric fuel pump O.K.?

Test specification:  
min. 1350 cm<sup>3</sup>/30 s

no

• Measuring the fuel delivery:

For testing, undo junction between fuel return connection (arrow) and fuel return line (to fuel tank).

Connect hose and lead into a 5 l vessel with graduated scale.

Disconnect pump relay. Insert jumper between term. 87 and term. 30 in connection base.

Electric fuel pump must operate.

Test specification:

Min.: 1350 cm<sup>3</sup>/30 s

Caution:

Jumper must be removed again after testing is completed.

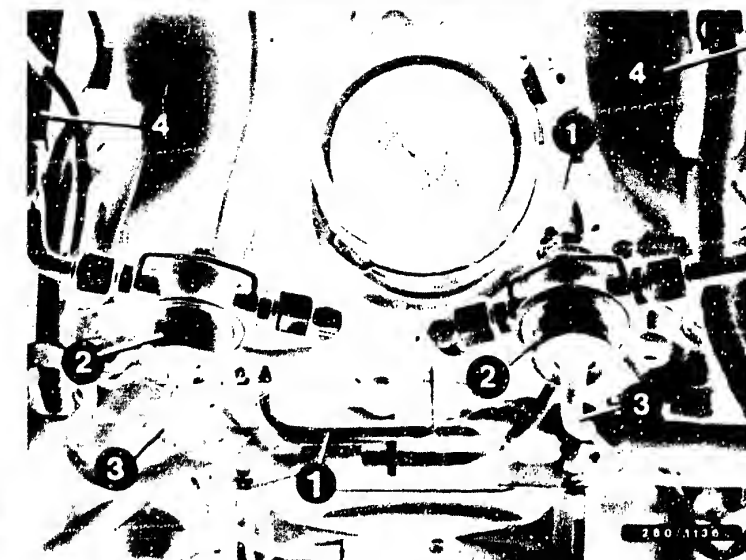
Remedy if test specification not obtained:

- Fuel filter clogged - replace.
- Voltage at terminals of electric fuel pump with engine running: min. 12 V. If not, clean contacts, possibly remedy poor ground connection, replace leads.
- Fuel pressure regulator defective - replace.
- If fuel delivery too low, replace electric fuel pump.

Testing completed: Remove jumper from connection base and connect pump relay. Re-connect fuel lines.

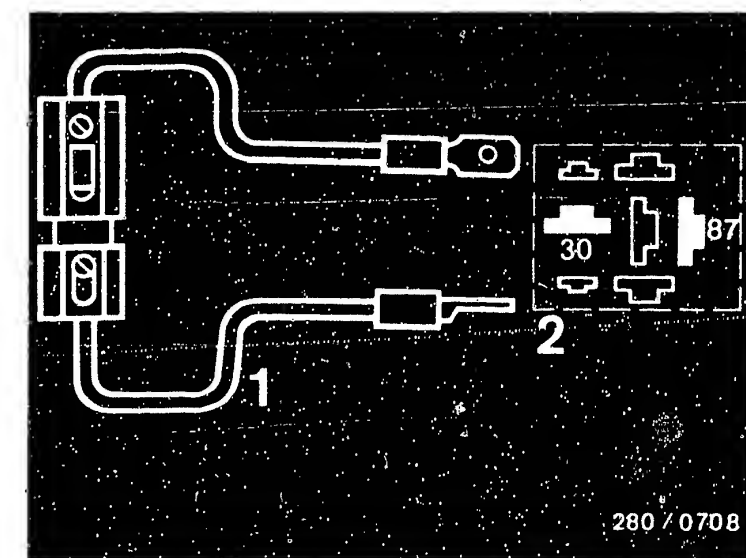
yes

Continued on K9/K10



- 1 = Fuel return line
- 2 = Pressure regulator
- 3 = Intake manifold connection
- 4 = Fuel-distribution pipe (fuel delivery line)

- 1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
- 2 = Top view of connection base



K7

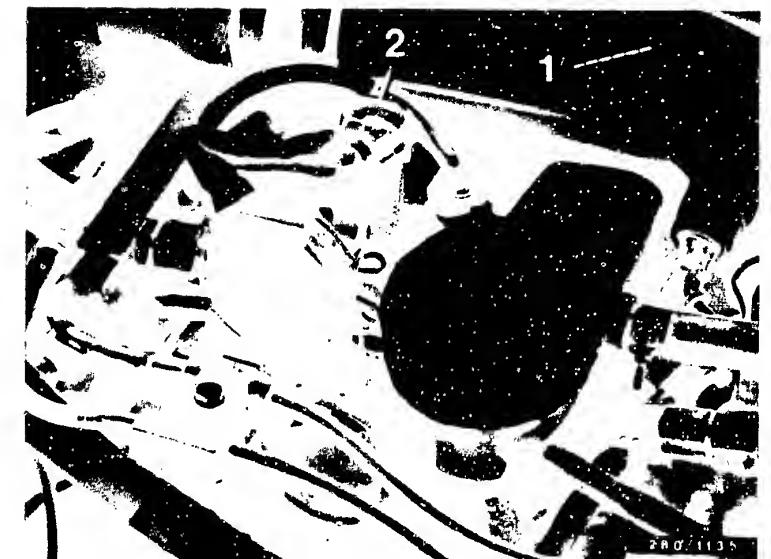
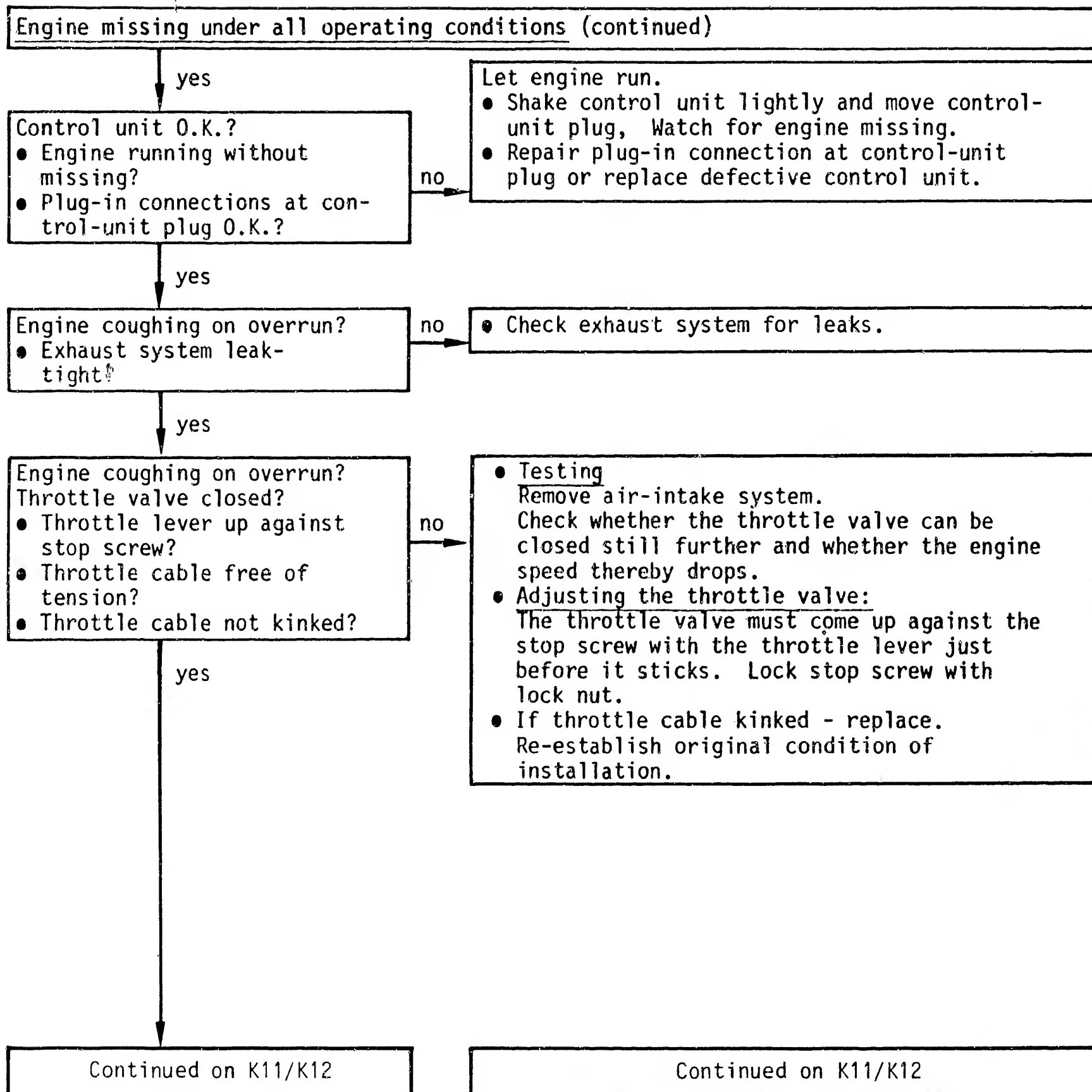
Engine missing  
Porsche 928 S USA



K8

Engine missing  
Porsche 928 S USA





1 = Throttle-valve switch  
2 = Adapter plug for throttle-valve switch connecting lead /Extension)

**K9**

Engine missing under all op. conditions  
Porsche 928 S USA



**K10**

Engine missing under all op. conditions  
Porsche 928 S USA





Engine missing under all operating conditions (continued)

yes

Engine coughing on overrun?  
Throttle-valve switch  
correctly adjusted?

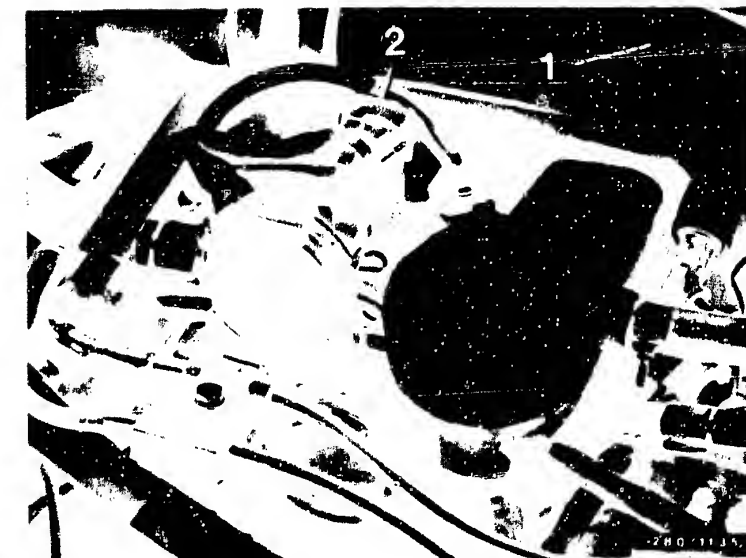
- Idle contact closing?
- Microswitch clicking audibly?

no

yes

Continued on K13/K14

- Adjusting the throttle-valve switch  
Remove air-intake system. Slightly loosen fastening screws of throttle-valve switch. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch to the left until the idle contact closes (microswitch clicks audibly). Reading 0  $\Omega$ .
- Checking the adjustment:  
Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading  $\infty \Omega$ .  
Re-establish original condition of installation.



- 1 = Throttle-valve switch  
2 = Adapter plug for throttle-valve switch connecting lead/Extension)

**K11**

Engine missing under all op. conditions  
Porsche 928 S USA



**K12**

Engine missing under all op. conditions  
Porsche 928 S USA



Engine missing under all operating conditions (continued)

yes

Engine coughing on overrun?  
Overrun cutoff O.K.?

- Operation of control unit O.K.?
- Reinstatement speed O.K.?

Cold:  $1630 \text{ min}^{-1}$   
Warm:  $1300 \text{ min}^{-1}$

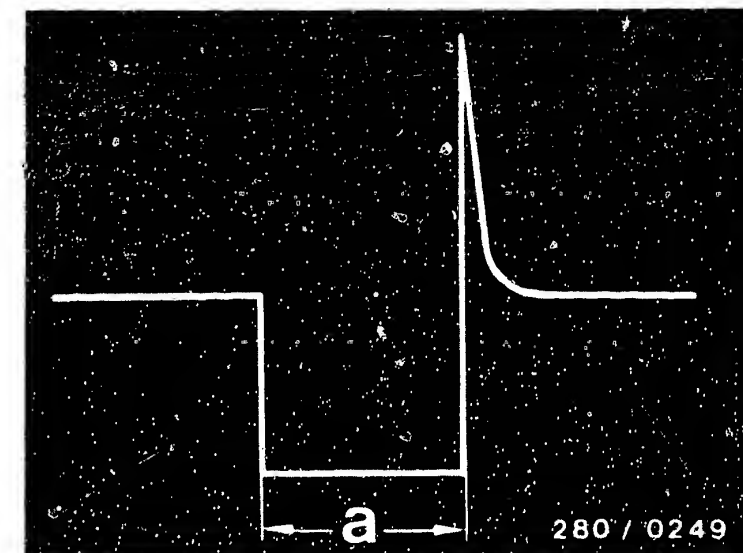
no

- Functional test of overrun cutoff:  
Connect test lead as follows:  
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two terminals of the test lead, only one need be connected to the special input of the motortester. If correctly connected, the pattern shown opposite is visible on the oscilloscope. Watch oscilloscope.
- Slowly raise engine speed to  $3000 \text{ min}^{-1}$ . Injection pulses must be visible on the oscilloscope. Release accelerator (idle position). No more injection pulses.
- Engine clearly below ambient temperature ( $+15^{\circ}\text{C} \dots +30^{\circ}\text{C}$ ):  
As of approx.  $1630 \text{ min}^{-1}$  injection pulses must be visible again. The cutoff speed is approx.  $330 \text{ min}^{-1}$  higher.
- Engine at normal operating temperature (approx.  $+80^{\circ}\text{C}$ ):  
As of approx.  $1300 \text{ min}^{-1}$  injection pulses must be visible again. The cutoff speed is approx.  $370 \text{ min}^{-1}$  higher.

If incorrect, replace control unit.

yes

Continued on K15/K16



Injection pulse of a switched output stage  
(Measured at the injection valve)  
a = Pulse length (dependent on engine load)

**K13**

Engine missing under all op. conditions  
Porsche 928 S USA



**K14**

Engine missing under all op. conditions  
Porsche 928 S USA



# Engine missing under all operating conditions (continued)

Injection valves checked for proper operation?  
Injection signal checked for missing?

- Injection pulses without interference or missing?
- Leads correctly routed?
- No loose contacts in plug-in connections?

no

- Connect test lead as follows:  
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one need be connected to the special input of the motortester.
- If correctly connected, the pattern shown opposite is visible on the oscilloscope. With the aid of the test lead it is possible to test the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if deviations (interference, missing etc) are visible, the other injection valves should also be tested.
- In case of interference: Check routing of leads.
- In case of missing: Eliminate loose contacts in the leads or in the plug-in connections.

yes

Injection valves O.K.?

- Removal and installation

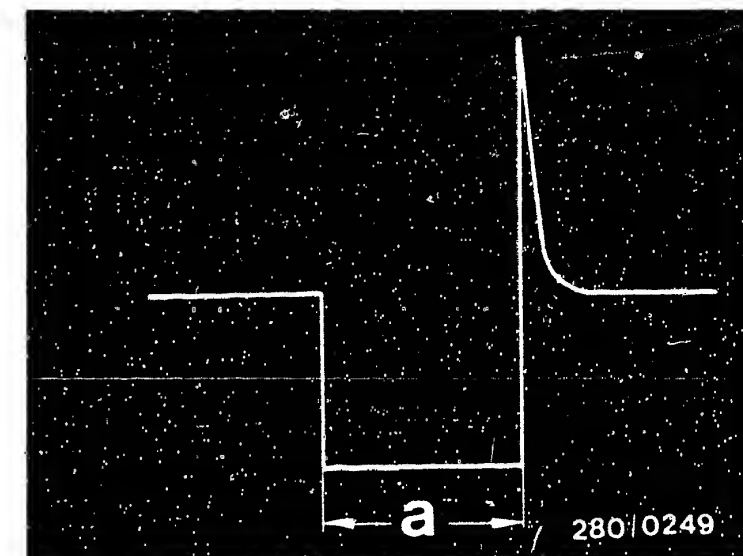
no

- Removal  
Removal fuel-distribution pipes with injection valves.
- Remove air intake hoses, air filter with top and bottom parts with hot-wire air-mass sensor.
- Remove air-intake system left/right.

yes

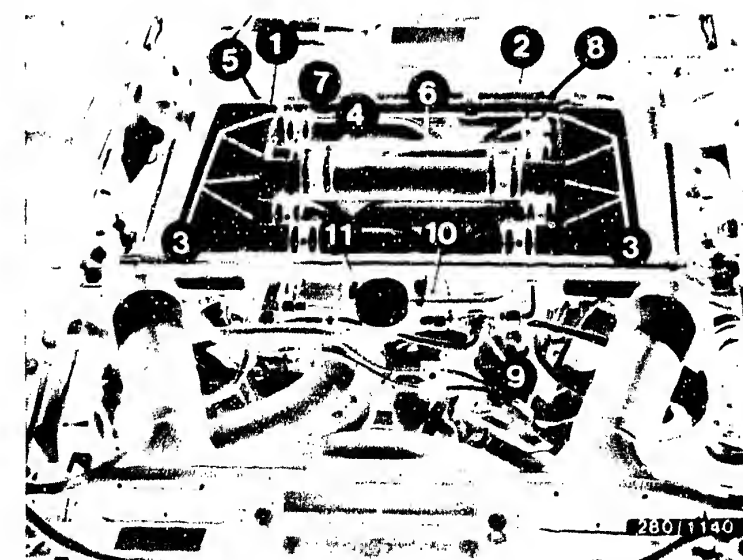
Continued on K19/K20

Continued on K17/K18



Injection pulses of a switched output stage  
(Measured at the injection valve)  
a = Pulse length (dependent on engine load)

3 = Injection valves



**K15**

Engine missing under all op. conditions  
Porsche 928 S USA



**K16**

Engine missing under all op. conditions  
Porsche 928 S USA



Engine missing under all operating conditions (continued)

yes

Injection valves O.K.?

● Removal and installation

no

yes

- Loosen fastening screws on fuel-distribution pipe and on injection valves.
- Loosen strut.
- Pull all 8/4 injection valves simultaneously and carefully out of the cylinder.  
If injection valves defective on one side, loosen fuel-distribution pipe at pressure regulator.
- Caution: Make sure that no fuel gets onto hot parts of the engine.
- Pull off electrical connection.
- Carefully slide holding clamp out of groove.
- Carefully remove injection valve from fuel-distribution pipe.

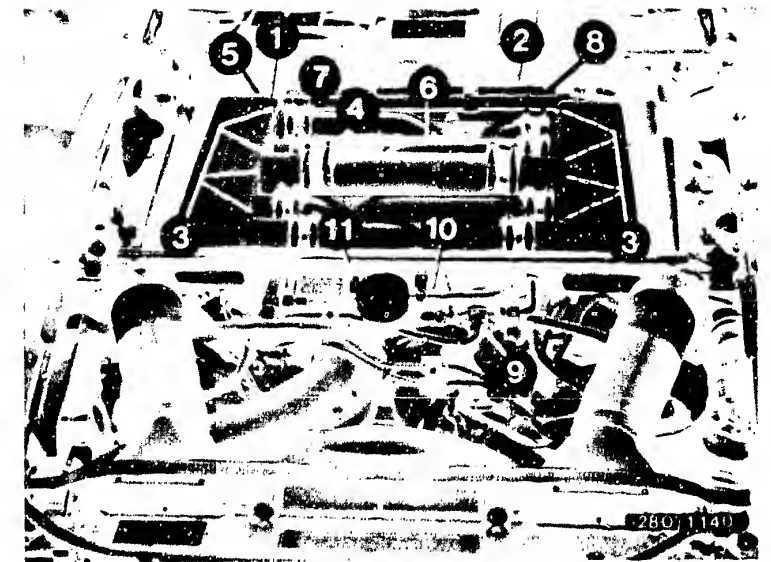
Caution: Do not allow escaping fuel to drip onto hot parts of the engine.

Warning: Before installation, the O-rings must be greased only lightly (silicone grease FT 2 v 1). The other parts must remain free of grease.

● Installation

- Carefully connect new solenoid-operated injection valve to fuel-distribution pipe.
- Slide holding clamp into groove until it latches (check O-rings for leaks). Ensure that the original condition of installation is re-established.

Continued on K19/K20



3 = Injection valves

1 = FD mark

2 = Upper O-ring

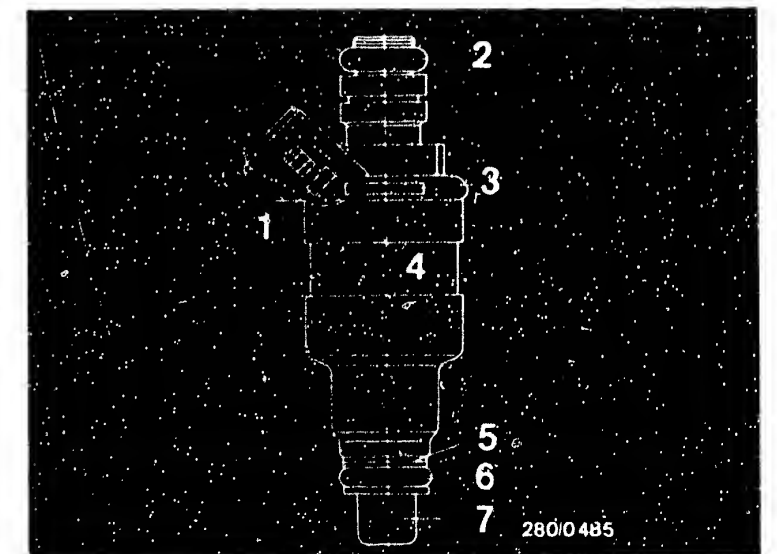
3 = Part number

4 = Injection valve

5 = Supporting plate

6 = Lower O-ring

7 = Protective sleeve



**K17**

Engine missing under all op. conditions  
Porsche 928 S USA



**K18**

Engine missing under all op. conditions  
Porsche 928 S USA



Engine missing under all operating conditions (continued)

yes

Trouble-shooting program  
completed for customer  
complaint

"Engine missing under all  
operating conditions".

Fault eliminated?

no

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8).  
If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**K19**

Engine missing under all op. conditions  
Porsche 928 S USA



**K20**

Engine missing under all op. conditions  
Porsche 928 S USA





## FUEL CONSUMPTION TOO HIGH

Trouble-shooting program according to customer complaint

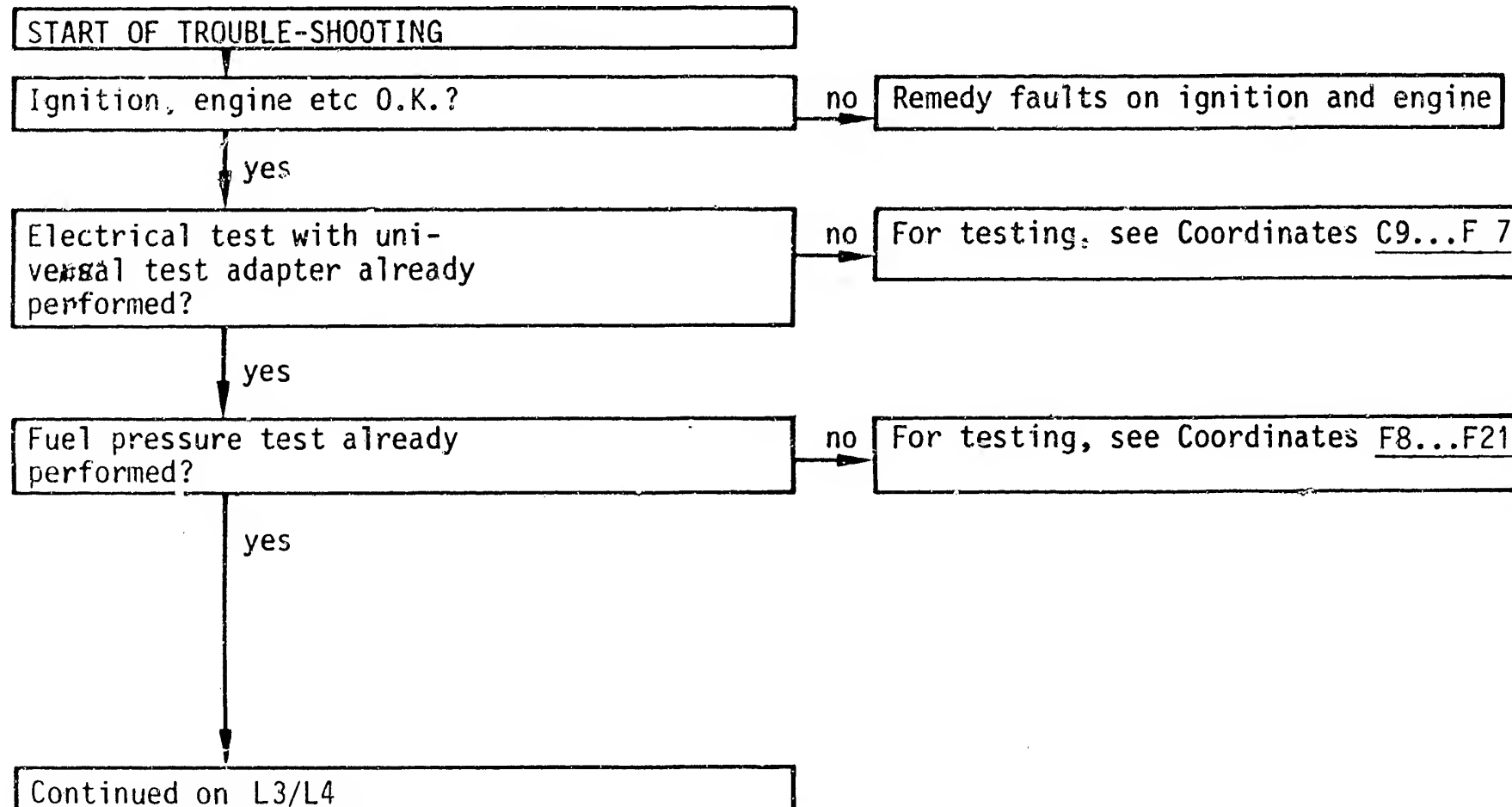
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



L1

Fuel consumption too high  
Porsche 928 S USA



L2

Fuel consumption too high  
Porsche 928 S USA



# Fuel consumption too high (continued)

yes

Hot-wire air-mass sensor mechanically and electrically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?  
Between term. 6 and term. 3:  
 $0...1100\ \Omega$   
Between term. 5 and term. 3:  
 $3.6...4.1\ \Omega$

no

## Removal

- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

**Warning:** Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).  
Disconnect plug.

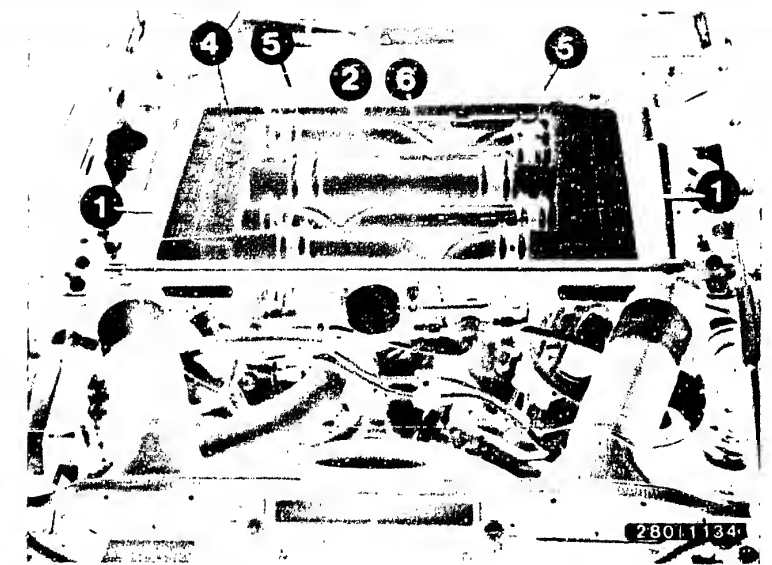
## Visual examination

- Plug correctly connected.
- Spring retainer snapped in position.
- Plug not turned round.
- No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
- Wire screen O.K. on both sides?  
If hot wire broken - replace hot-wire air-mass sensor.

yes

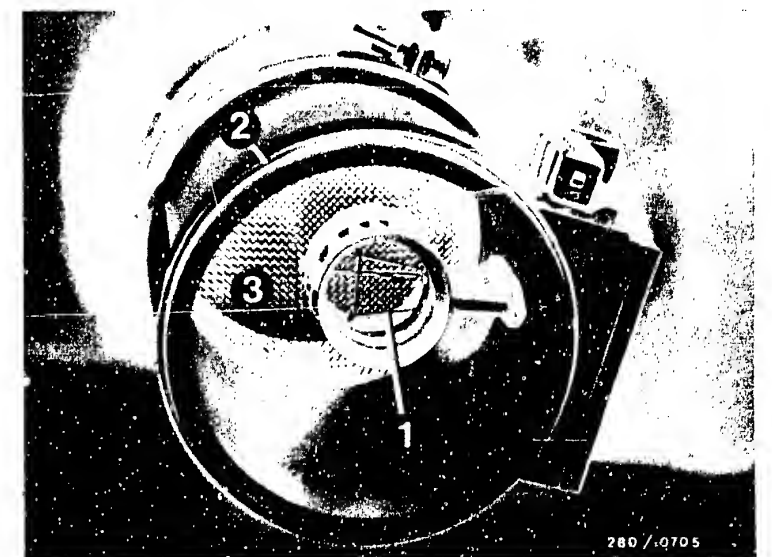
Continued on L7/L8

Continued on L5/L6



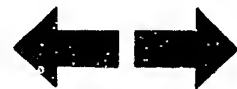
- 1 = Intake hose
- 2 = Air-filter housing top part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor

- 1 = Hot wire
- 2 = O-ring (dust protection)
- 3 = Wire screen



L3

Fuel consumption too high  
Porsche 928 S USA



L4

Fuel consumption too high  
Porsche 928 S USA



# Fuel consumption too high (continued)

## • Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.

Resistance measurement

between term. 6 and term. 3:

0...1100  $\Omega$

between term. 5 and term. 3:

3.6...4.1  $\Omega$

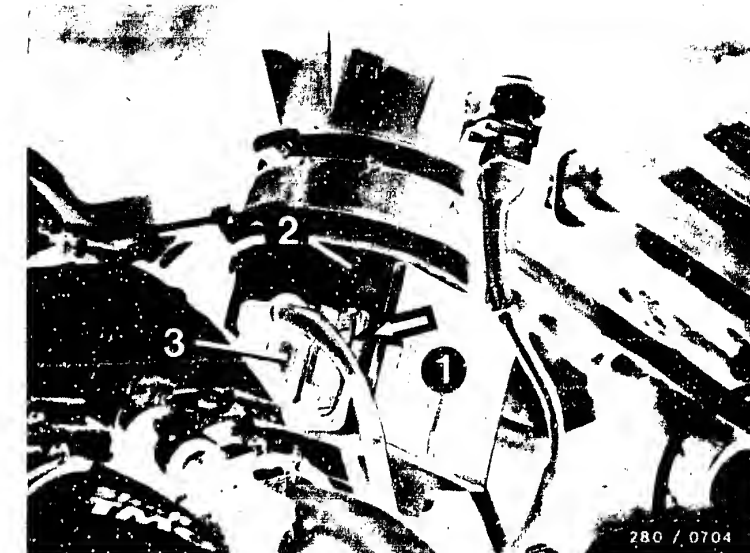
If incorrect, replace hot-wire air-mass sensor.

## Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.

yes

Continued on L7/L8



1 = Hot-wire air-mass sensor

3 = Plug

Press retainer in direction of arrow when disconnecting plug

1 = Intake hose

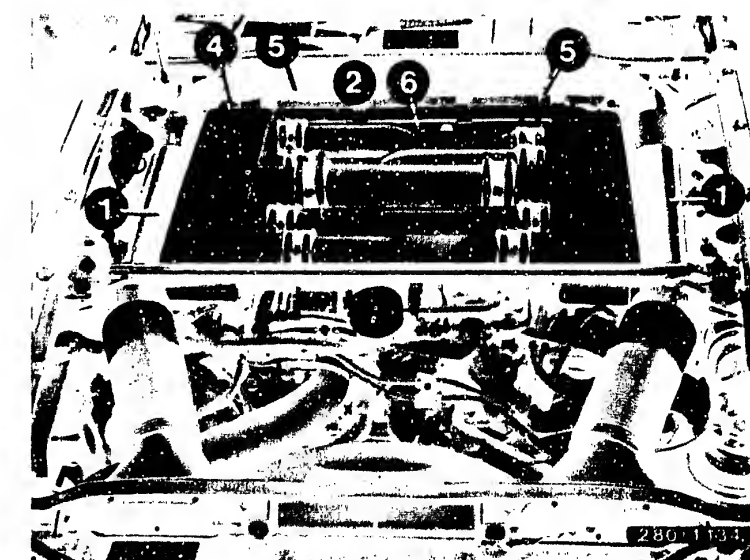
2 = Air-filter housing top part

3 = Air-filter housing bottom part

4 = Hose to blow-off change-over valve

5 = Hexagon screws

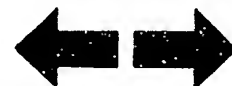
6 = Hot-wire air-mass sensor



L5

Fuel consumption too high

Porsche 928 S USA



L6

Fuel consumption too high

Porsche 928 S USA



## Fuel consumption too high (continued)

yes

Injection valves checked for proper operation?

- Diagram shown opposite visible on oscilloscope?
- No deviation or missing or interference detectable?

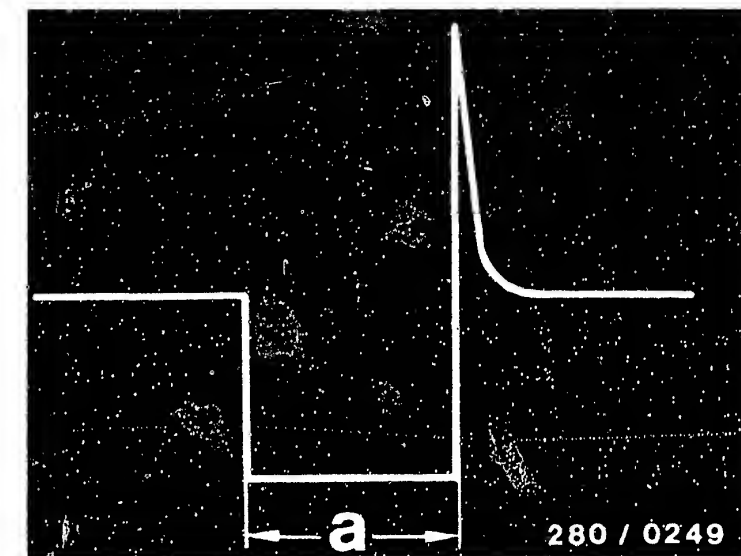
no

### Functional test of injection valves

- Connect test lead as follows:  
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one need be connected to the special input of the motortester.
- Caution:  
The unoccupied terminal must not come into contact with the bodywork.
- If correctly connected, the pattern shown opposite is visible on the oscilloscope. With the aid of the test lead it is possible to test the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if deviations (interference, missing etc) are visible, the other injection valves should also be tested.
- In case of interference: Check routing of leads.
- In case of missing: Eliminate loose contacts in the leads or in the plug-in connections.

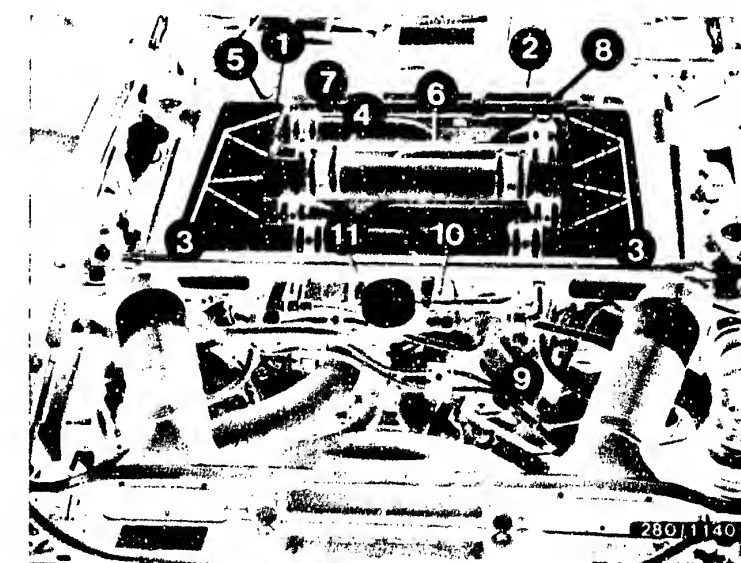
yes

Continued on L9/L10



Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load).

3 = Injection valves



**L7**

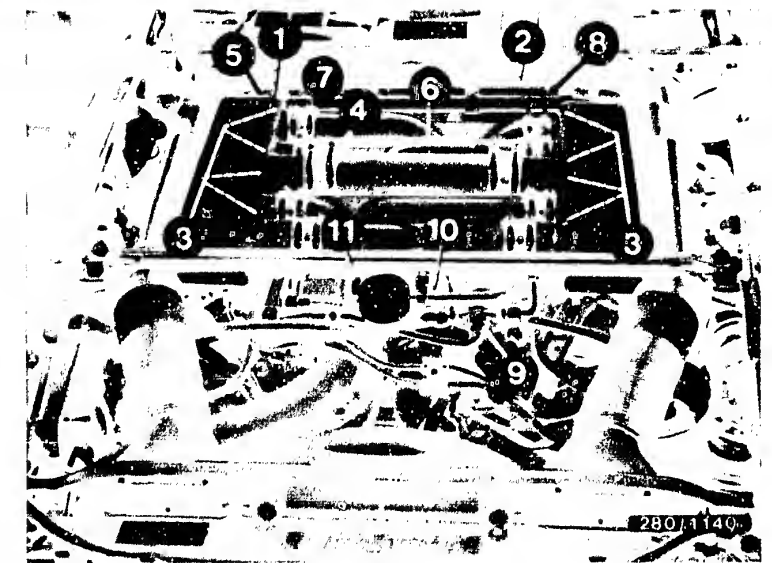
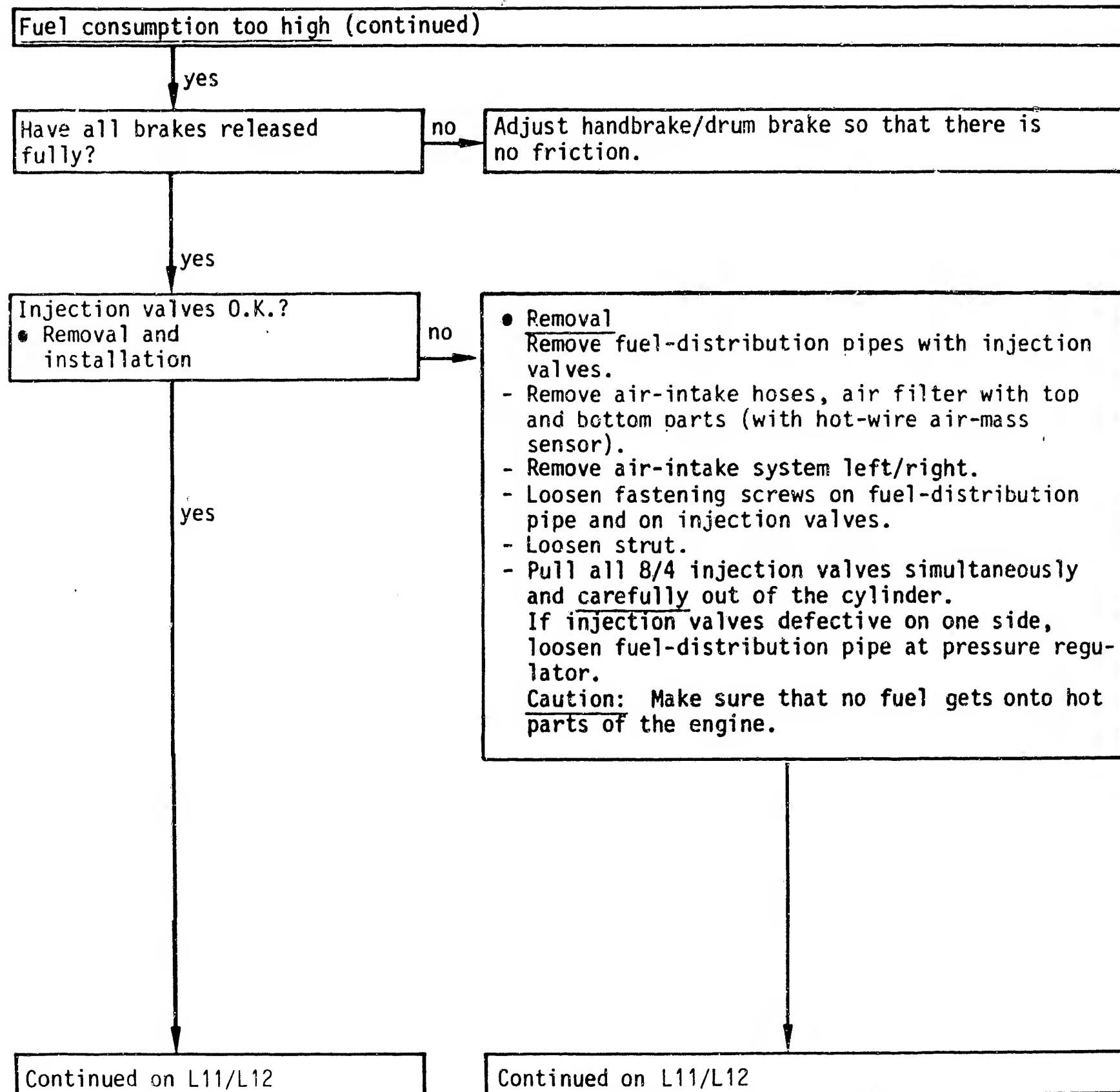
Fuel consumption too high  
Porsche 928 S USA



**L8**

Fuel consumption too high  
Porsche 928 S USA





3 = Injection valves





# Fuel consumption too high (continued)

yes

- Pull off electrical connection.
- Carefully slide holding clamp out of groove.
- Carefully remove injection valve from fuel-distribution pipe.

Caution: Do not allow escaping fuel to drip onto hot parts of the engine.

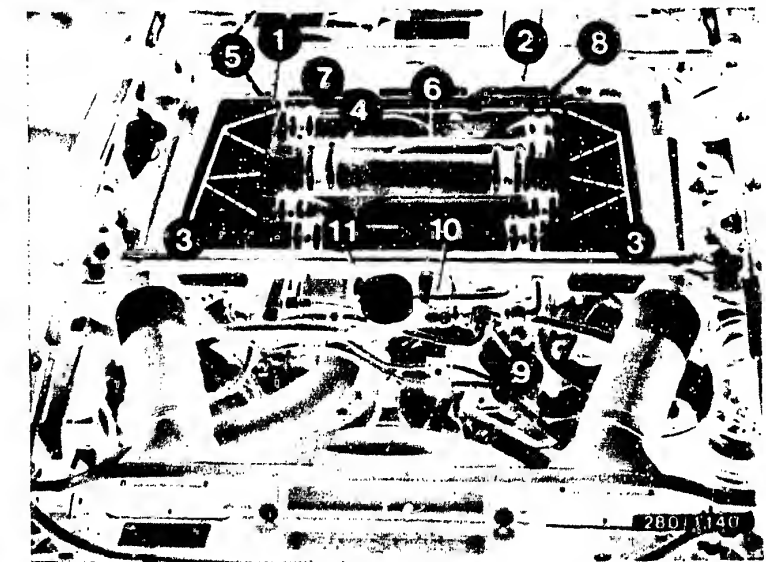
Warning: Before installation, the O-rings must be greased only lightly (silicone grease FT 2 v 1). The other parts must remain free of grease.

## ● Installation

- Carefully connect new solenoid-operated injection valve to fuel-distribution pipe.
- Slide holding clamp into groove until it latches (check O-rings for leaks). Ensure that the original condition of installation is re-established.

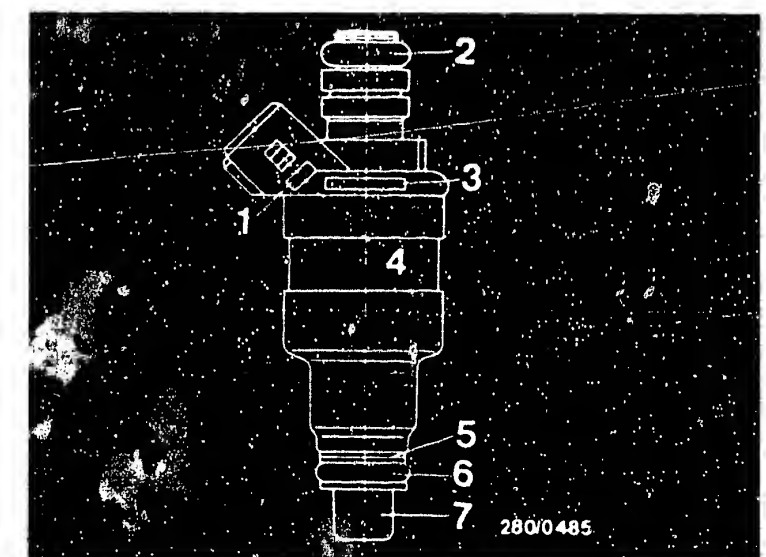
## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



3 = Injection valves

- 1 = FD mark
- 2 = Upper O-ring
- 3 = Part number
- 4 = Injection valve
- 5 = Supporting plate
- 6 = Lower O-ring
- 7 = Protective sleeve



Trouble-shooting program completed for customer complaint

"Fuel consumption too high"

Fault eliminated?

no

L11

Fuel consumption too high  
Porsche 928 S USA



L12

Fuel consumption too high  
Porsche 928 S USA



## MAXIMUM ENGINE POWER, TOP SPEED NOT REACHED

Trouble-shooting program according to customer complaint

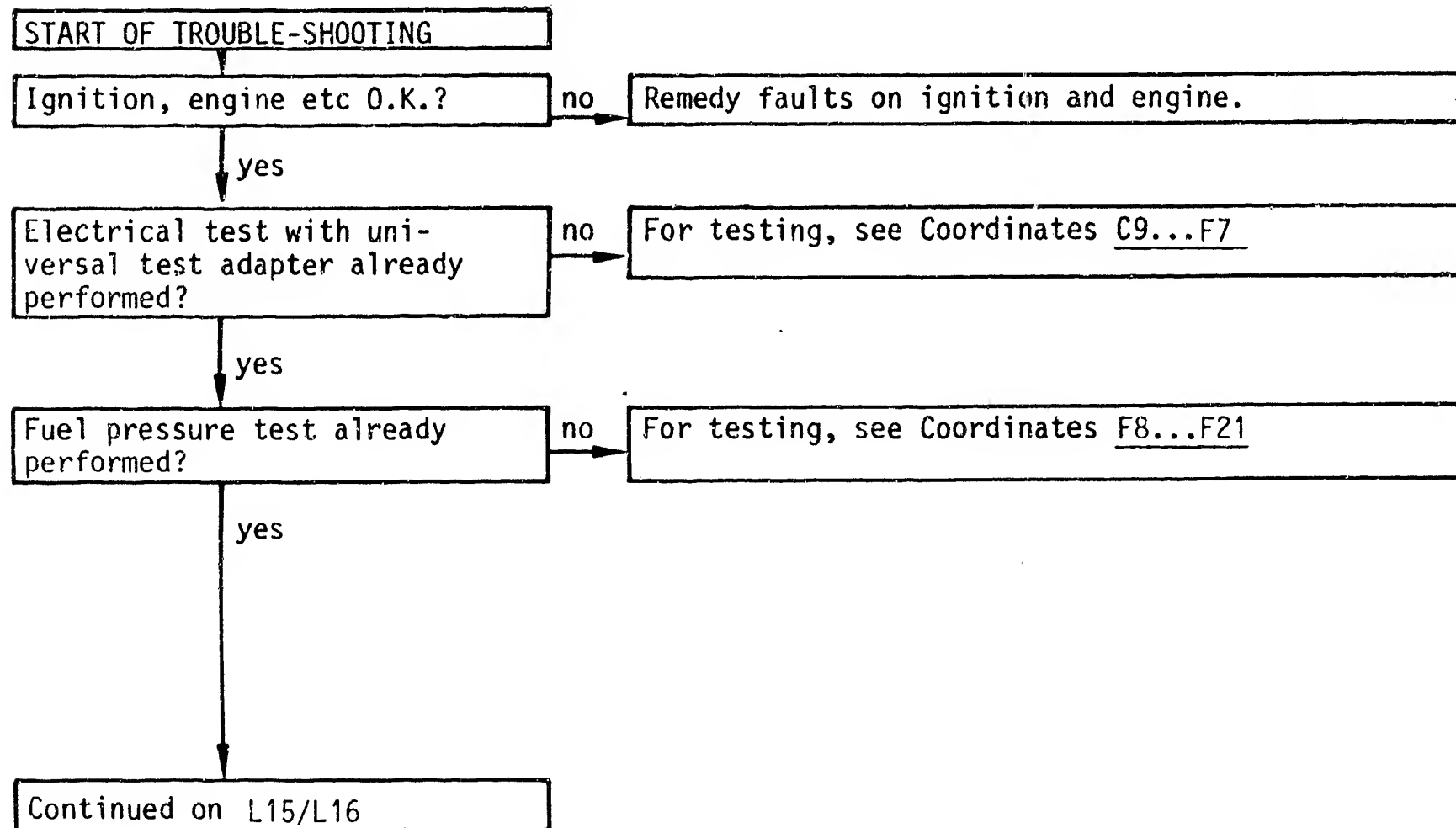
### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**L13**

No maximum engine power

Porsche 928 S USA

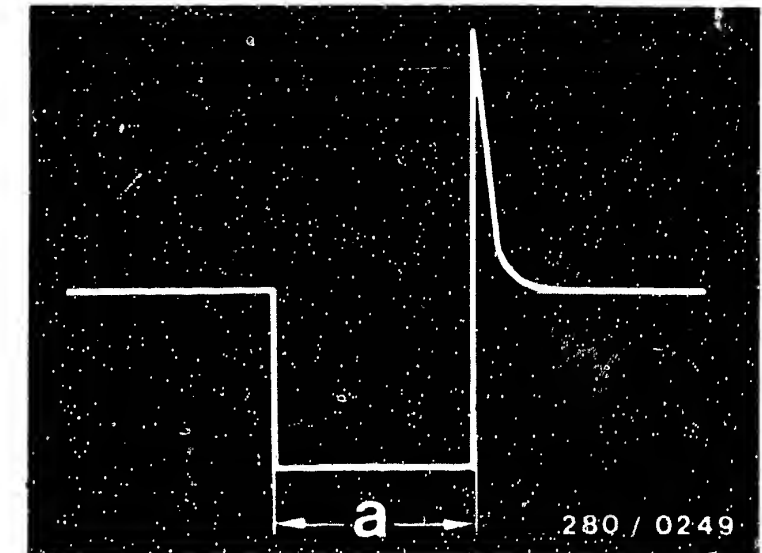
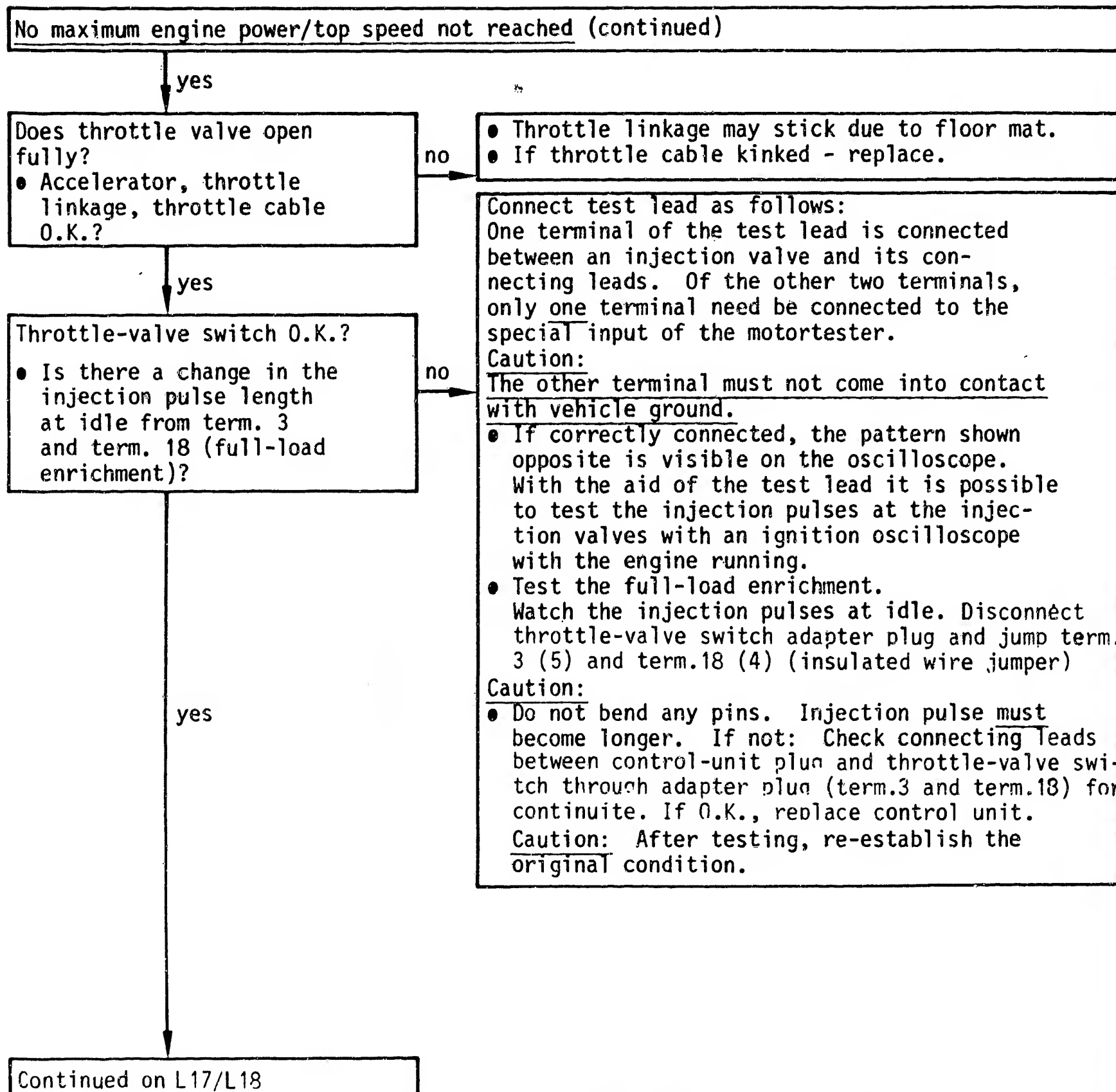


**L14**

No maximum engine power

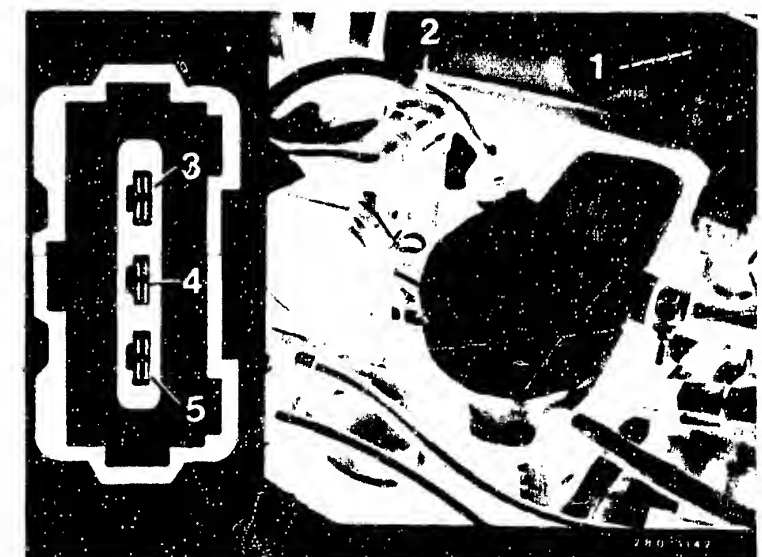
Porsche 928 S USA





Injection pulses of a switched output stage (measured at the injection valve)  
 a = Pulse length (dependent on engine load).

- 1 = Throttle-valve switch  
 2 = Adapter plug for throttle-valve switch connecting lead/Extension)



**L15**

No maximum engine power  
 Porsche 928 S USA



**L16**

No maximum engine power  
 Porsche 928 S USA



Maximum engine power/top speed not reached (continued)

yes

Fuel delivery of electric fuel pump O.K.?

Test specification:  
min. 1350 cm<sup>3</sup>/30 s

no

● Measuring the fuel delivery:

For testing, undo junction between fuel return connection (arrow) and fuel return line (to fuel tank).

Connect hose and lead into a 5 l vessel with graduated scale.

Disconnect pump relay. Insert jumper between term. 87 and term. 30 in connection base.

Electric fuel pump must operate.

Test specification:

Min.: 1350 cm<sup>3</sup>/30 s

Caution:

Jumper must be removed again after testing is completed.

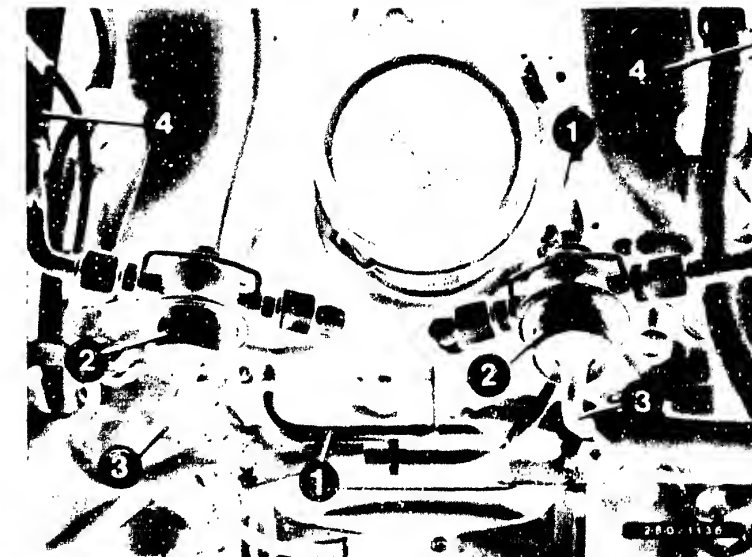
Remedy if test specification not obtained:

- Fuel filter clogged - replace.
- Voltage at terminals of electric fuel pump with engine running: min. 12 V. If not, clean contacts, possibly remedy poor ground connection, replace leads.
- Fuel pressure regulator defective - replace.
- If fuel delivery too low, replace electric fuel pump.

Testing completed: Remove jumper from connection base and connect pump relay. Re-connect fuel lines.

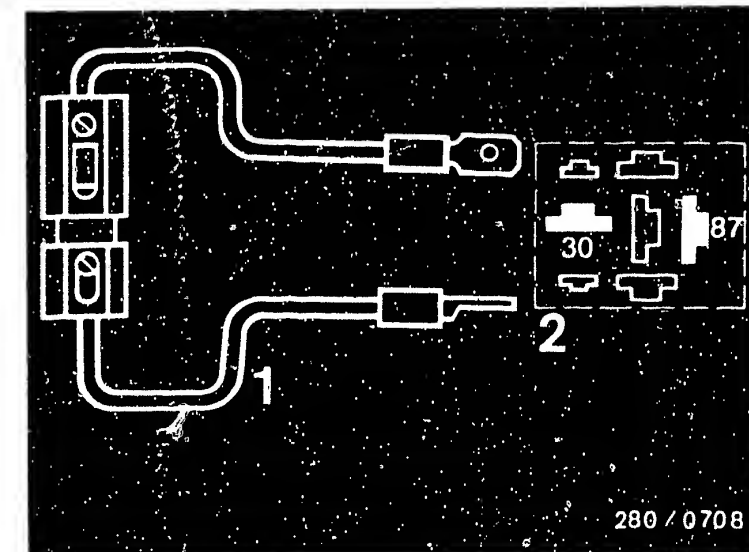
yes

Continued on L19/L20



- 1 = Fuel return line
- 2 = Pressure regulator
- 3 = Intake manifold connection
- 4 = Fuel-distribution pipe (fuel delivery line)

- 1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
- 2 = Top view of connection base



280 / 0708

L17

No maximum engine power  
Porsche 928 S USA



L18

No maximum engine power  
Porsche 928 S USA



Maximum engine power/top speed not reached (continued)

yes

Hot-wire air-mass sensor  
mechanically and elec-  
trically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?  
Between term. 6 and term. 3:  
0...1100  $\Omega$   
Between term. 5 and term. 3:  
3.6...4.1  $\Omega$

no

#### Removal

- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

**Warning:** Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).  
Disconnect plug.

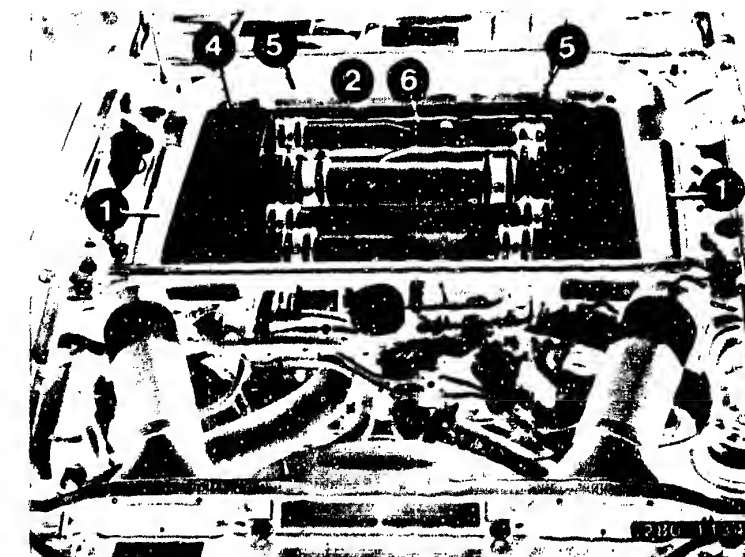
#### Visual examination

- Plug correctly connected.
- Spring retainer snapped in position.
- Plug not turned round.
- No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
- Wire screen O.K. on both sides?  
If hot wire broken - replace hot-wire air-mass sensor.

yes

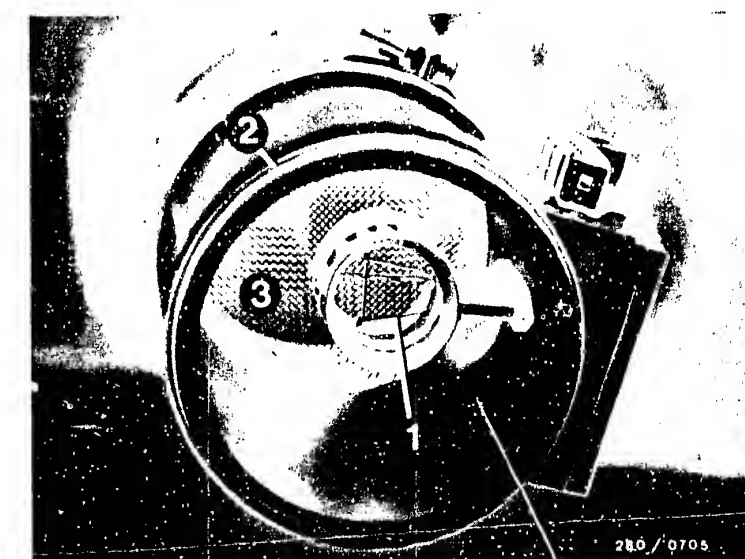
Continued on L23/L24

Continued on L21/L22



- 1 = Intake hose
- 2 = Air-filter housing top part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor

- 1 = Hot wire
- 2 = O-ring (dust protection)
- 3 = Wire screen



**L19**

No maximum engine power  
Porsche 928 S USA



**L20**

No maximum engine power  
Porsche 928 S USA





yes

• Electrical test

- Disconnect plug. Set multimeter/motortester to  $\Omega$  range.

Resistance measurement

between term. 6 and term. 3:

0...1100  $\Omega$

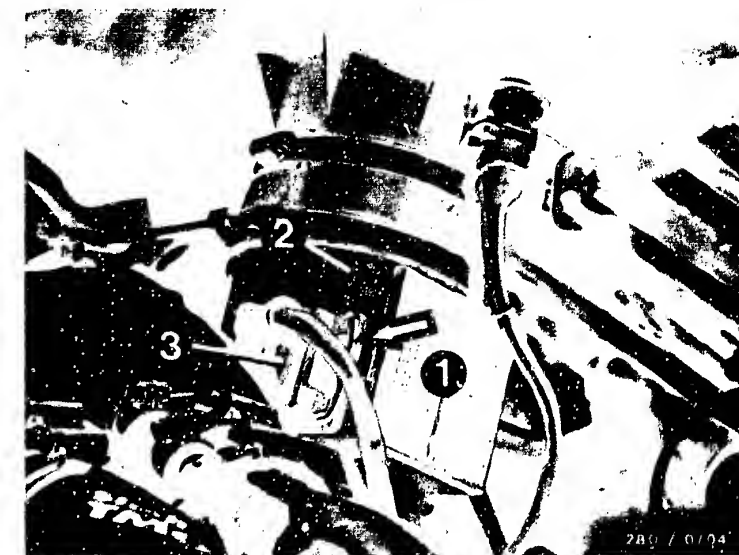
between term. 5 and term. 3:

3.6...4.1  $\Omega$

If incorrect, replace hot-wire air-mass sensor.

Installation

- Connect plug to hot-wire air-mass sensor (right way round).
- Lightly grease O-ring in fitting (use acid-free grease).  
Ensure correct position of O-ring.
- Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
- Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
- Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
- Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
- Assemble air filter and fasten with rubber bands.
- Correctly connect air intake hoses.



1 = Hot-wire air-mass sensor

3 = Plug

Press retainer in direction of arrow when disconnecting plug

1 = Intake hose

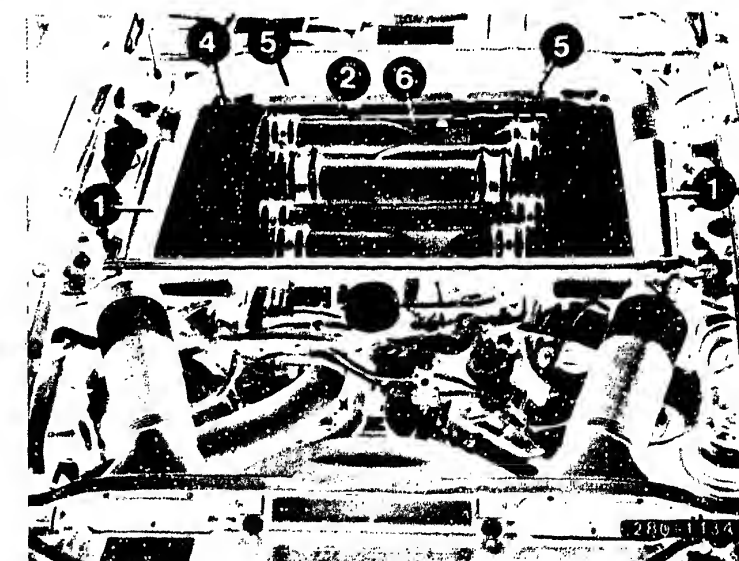
2 = Air-filter housing top part

3 = Air-filter housing bottom part

4 = Hose to blow-off change-over valve

5 = Hexagon screws

6 = Hot-wire air-mass sensor



Continued on L23/L24

**L21**

No maximum engine power

Porsche 928 S USA

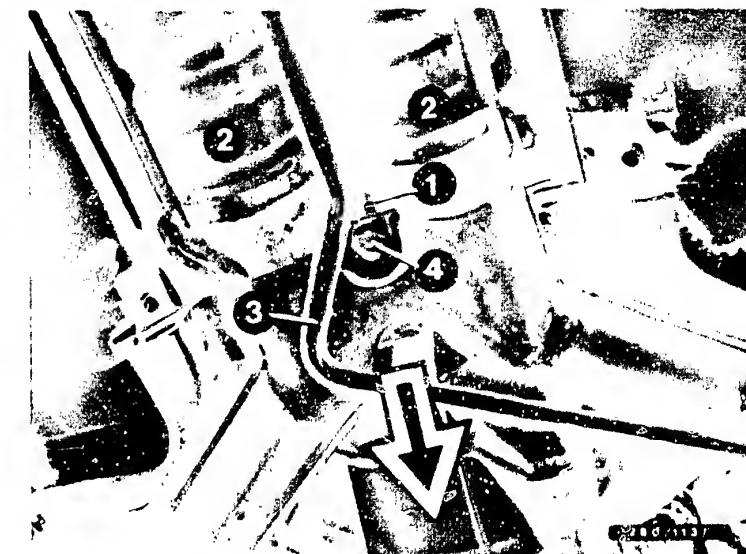
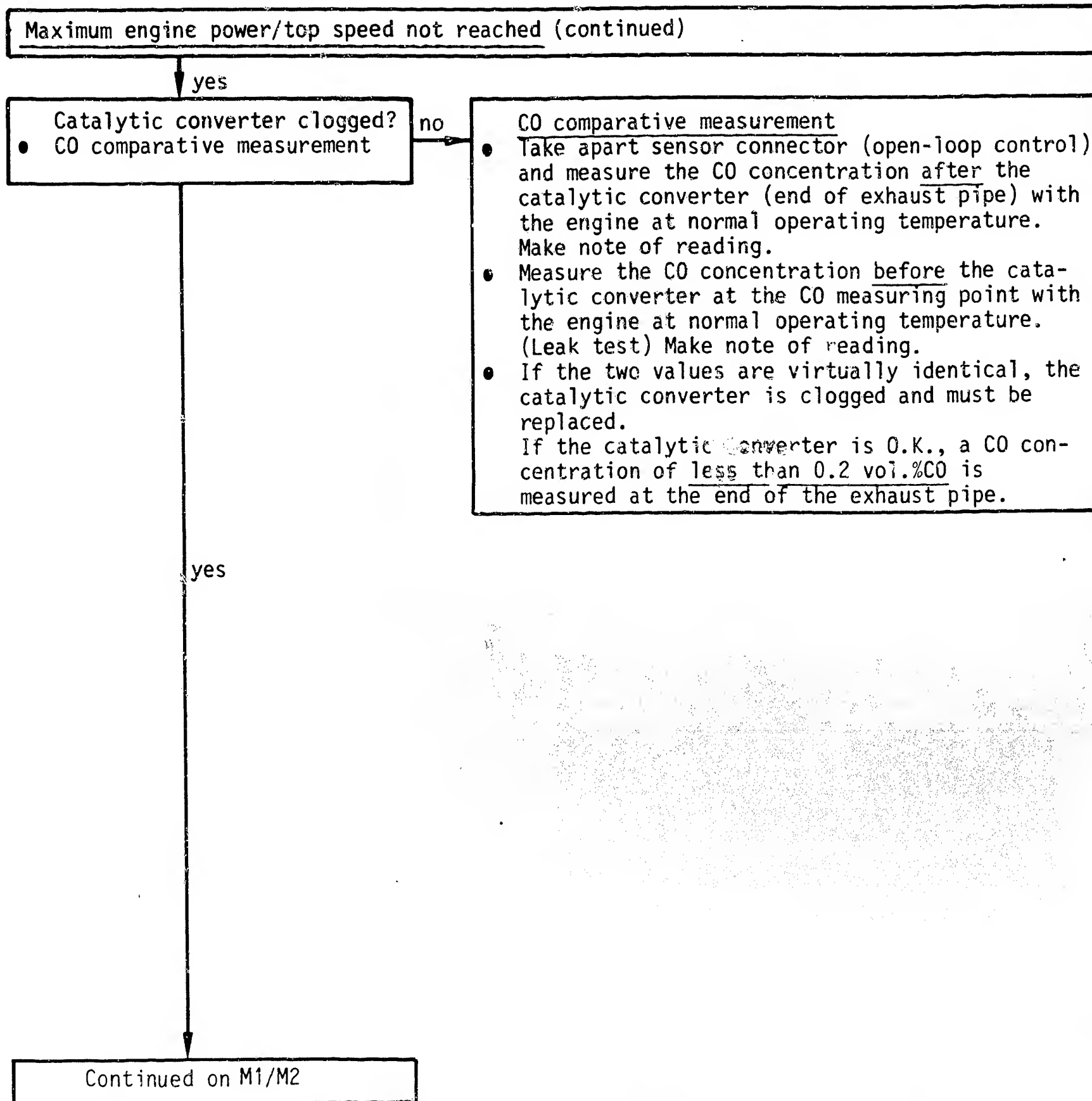


**L22**

No maximum engine power

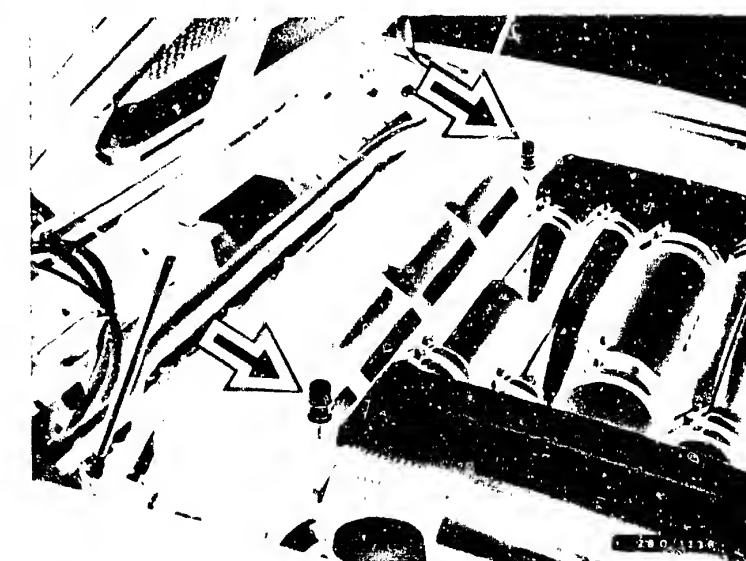
Porsche 928 S USA





- 1 = heated lambda sensor
- 2 = Catalytic converter
- 3 = Auxiliary-air injection line
- Arrow = Direction of travel
- 4 = CO measuring point before catalytic converter

Arrows = Measuring point before catalytic converter



**L23**

No maximum engine power  
Porsche 928 S USA

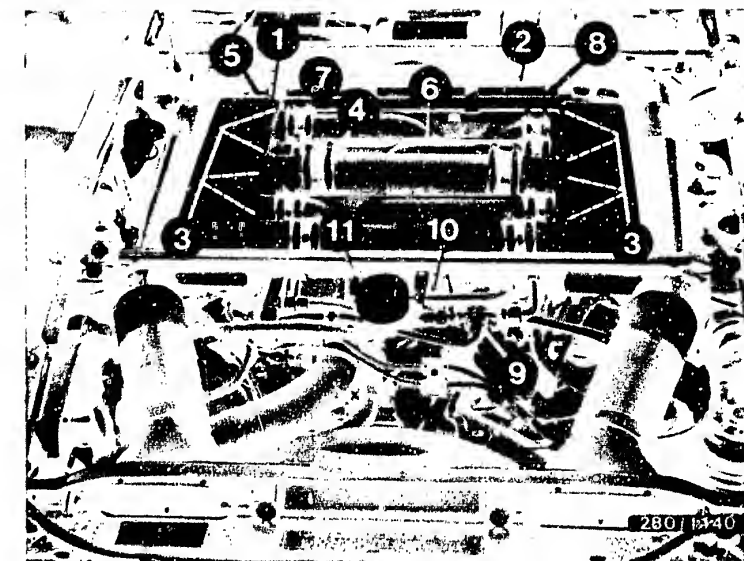
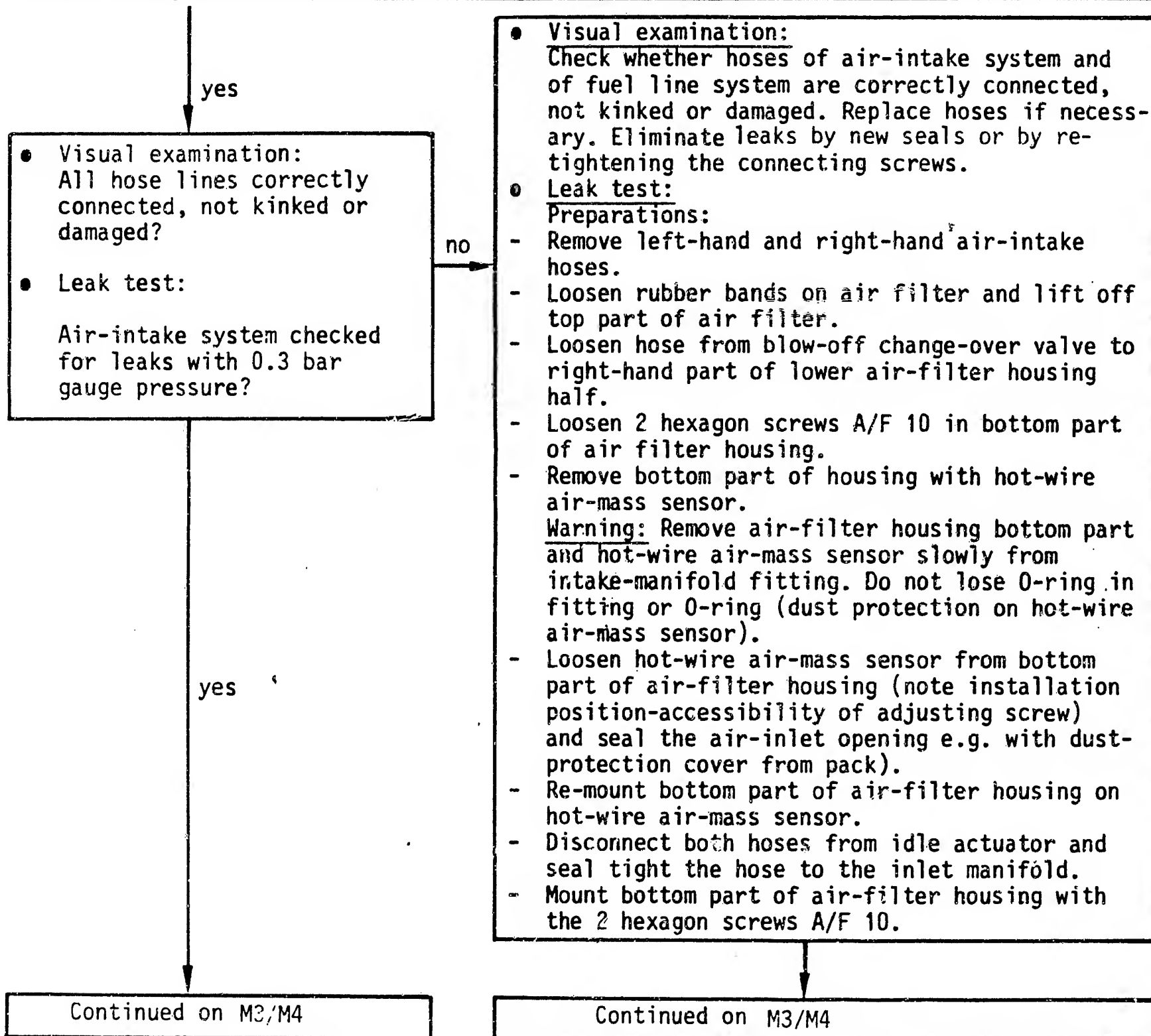


**L24**

No maximum engine power  
Porsche 928 S USA



Maximum engine power/top speed not reached (continued)



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

M1

No maximum engine power  
Porsche 928 S USA



M2

No maximum engine power  
Porsche 928 S USA



# Maximum engine power/top speed not reached (continued)

yes

Trouble-shooting program completed for customer complaint

"Maximum engine power/top speed not reached".

Fault eliminated?

no

## • Testing

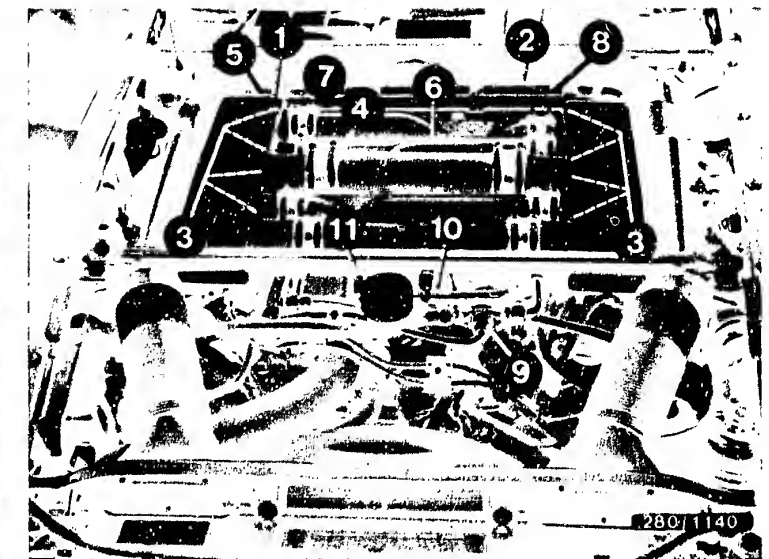
- Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
- Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:
- Oil dipstick not securely inserted.
- Defective cap seal on oil filler neck.
- O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
- Bubbling or foaming indicates a leak.

## • Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover. Re-establish the original condition.

## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

M3

No maximum engine power  
Porsche 928 S USA



M4

No maximum engine power  
Porsche 928 S USA



## IDLE SPEED AND CO CONCENTRATION TOO LOW OR TOO HIGH

### Trouble-shooting program according to customer complaint

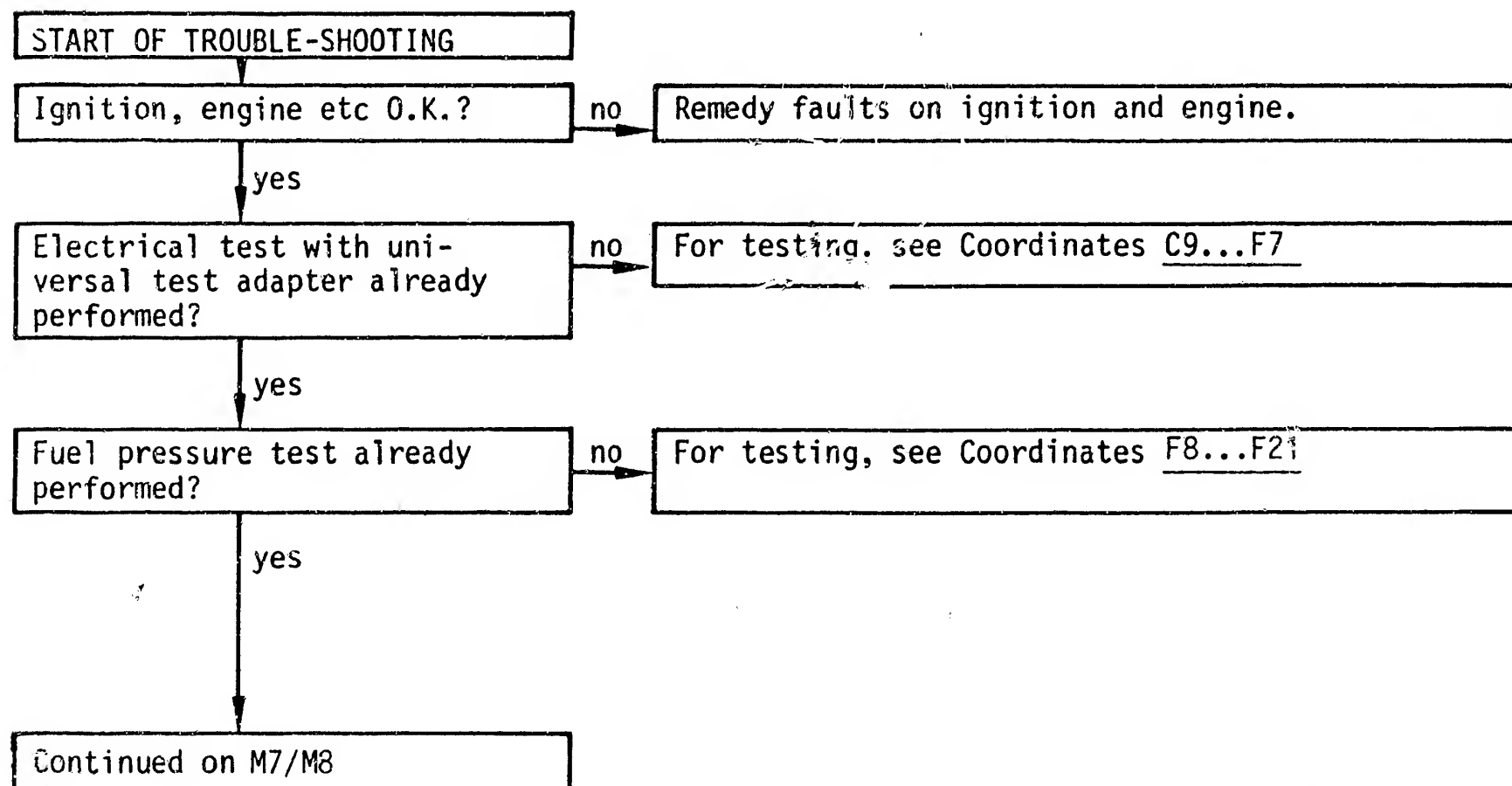
#### Procedure

The test is divided into 3 rows of boxes:

- The left-hand row contains the questions on the tests.
- The center row contains the testing and adjusting operations on the components.
- The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there. After the test has been completed, continue trouble-shooting at the point at which you branched off.



**M5**

Idle speed and CO adjustment  
Porsche 928 S USA



**M6**

Idle speed and CO adjustment  
Porsche 928 S USA





Idle speed and CO concentration too low or too high (continued)

yes

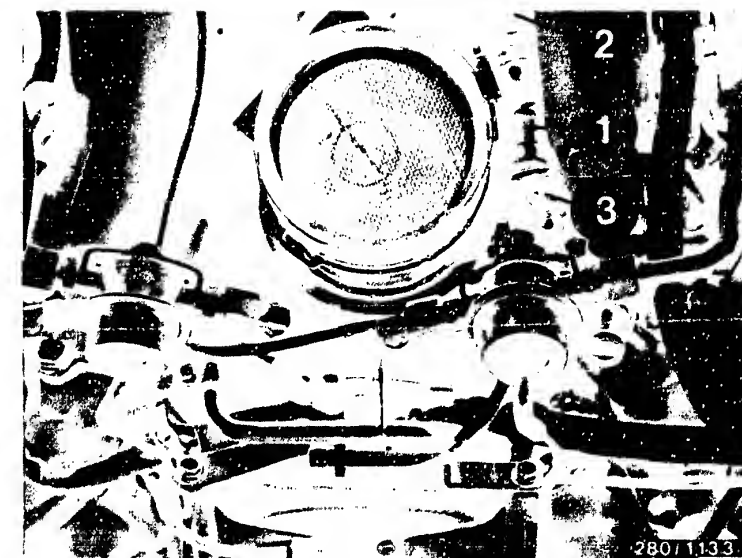
Idle actuator mechanically  
O.K.?

no

- The idle actuator is checked for correct electrical operation with the universal test adapter.
- Mechanical test  
Removal of hot-wire air-mass sensor
- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition).
- Remove housing bottom part.  
Warning: Remove bottom part of air filter housing and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection). Disconnect plug.
- Removal of idle actuator  
The idle actuator is checked for freedom of movement as follows:
  - Remove idle actuator (disconnect hoses).
  - Disconnect plug. Connect center connection (term. 2) to battery voltage.
  - Connect outer connection (term. 1) to ground.
  - Visually examine whether the rotary slider turns to the limit stop.
  - Change over outer connection, i.e. connect term. 3 to ground. Rotary slider must now turn to opposite stop.Replace idle actuator if defective.  
When installing the idle actuator, pay attention to its direction of flow (arrow).
- Re-establish the original condition.

yes

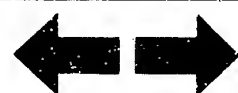
Continued on M9/M10



- 1 = Idle actuator  
2 = Connecting hoses  
3 = Plug

**M7**

Idle speed and CO adjustment  
Porsche 928 S USA



**M8**

Idle speed and CO adjustment  
Porsche 928 S USA



Idle speed and CO concentration too low or too high (continued)

yes

Hot-wire air-mass sensor mechanically and electrically O.K.?

- Hot wire not broken?
- Resistance values within tolerance?  
Between term. 6 and term. 3:  
 $0...1100\ \Omega$   
Between term. 5 and term. 3:  
 $3.6...4.1\ \Omega$

no

#### Removal

- Remove left-hand and right-hand air intake hoses.
- Loosen rubber bands on air filter and lift off top part
- Loosen hose from blow-off change-over valve to right-hand part of lower half of air filter housing.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Disconnect plug from NTC (ignition)
- Remove housing bottom part.

Warning: Withdraw bottom part of air filter housing and hot-wire air-mass sensor slowly from the intake manifold fitting. Do not lose O-ring (in fitting) and O-ring (dust protection).  
Disconnect plug.

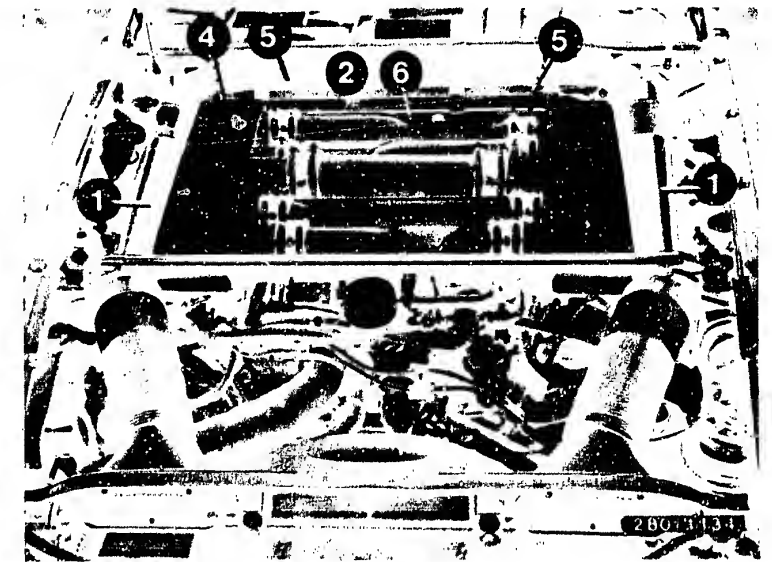
#### Visual examination

- Plug correctly connected.
- Spring retainer snapped in position.
- Plug not turned round.
- No pins pushed back or poor contact. Make sure that seal is correctly seated in plug.
- Wire screen O.K. on both sides?  
If hot wire broken - replace hot-wire air-mass sensor.

yes

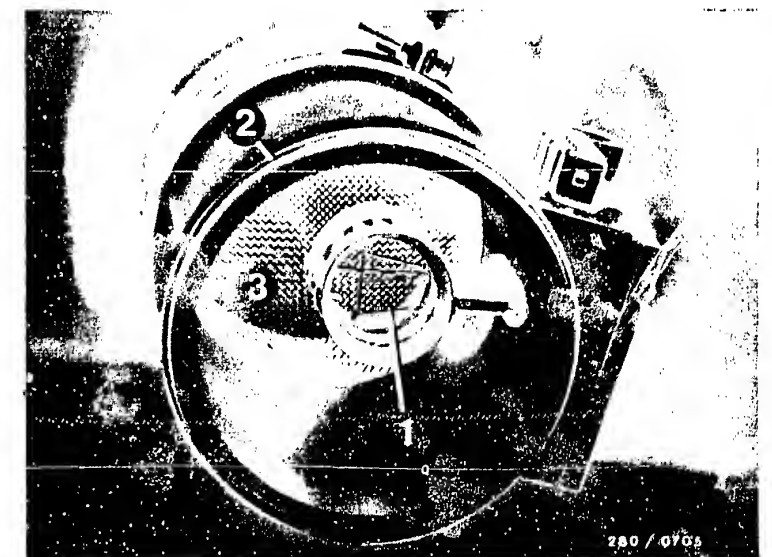
Continued on M13/M14

Continued on M11/M12



- 1 = Intake hose
- 2 = Air-filter housing top part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor

- 1 = Hot wire
- 2 = O-ring (dust protection)
- 3 = Wire screen



M9

Idle speed and CO adjustment  
Porsche 928 S USA



M10

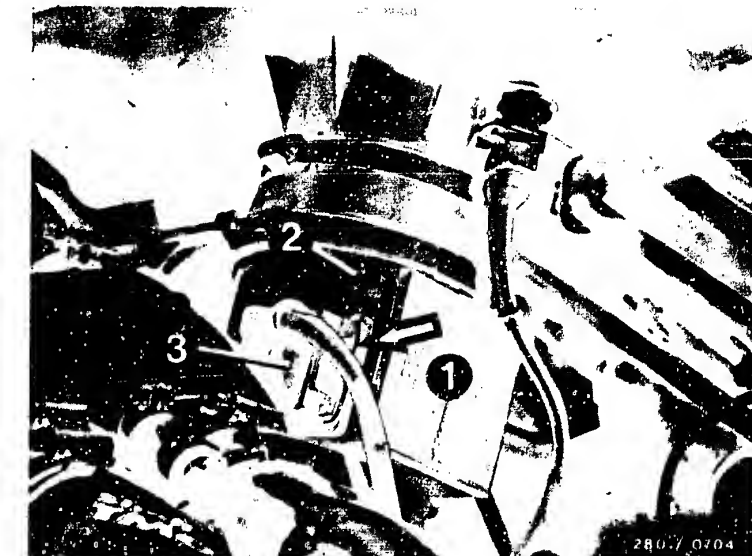
Idle speed and CO adjustment  
Porsche 928 S USA



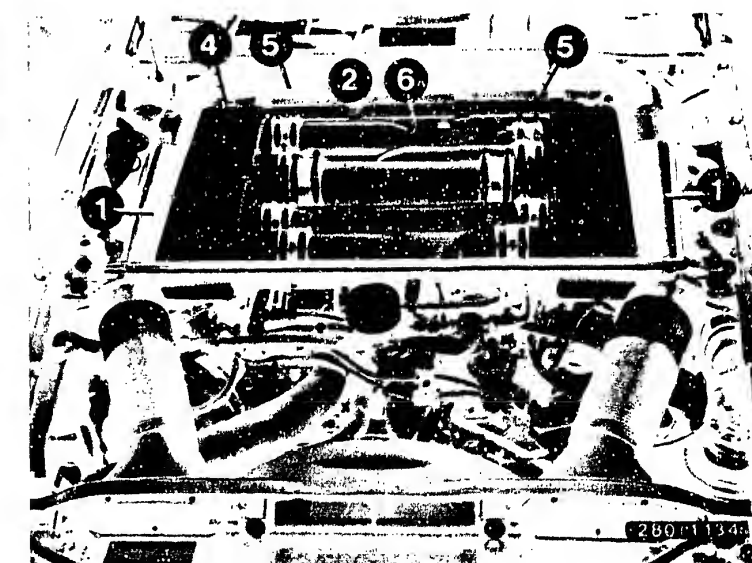
# Idle speed and CO concentration too low or too high (continued)

yes

- Electrical test
  - Disconnect plug. Set multimeter/motortester to  $\Omega$  range.
  - Resistance measurement
    - between term. 6 and term. 3:  
0...1100  $\Omega$
    - between term. 5 and term. 3:  
3.6...4.1  $\Omega$
  - If incorrect, replace hot-wire air-mass sensor.
- Installation
  - Connect plug to hot-wire air-mass sensor (right way round).
  - Lightly grease O-ring in fitting (use acid-free grease).
  - Ensure correct position of O-ring.
  - Provide idle-mixture-adjusting screw with aluminum plug 1 283 123 004.
  - Carefully press bottom part of air filter housing with hot-wire air-mass sensor into intake manifold fitting. When mounting, pay attention to position and leak-tightness of O-ring and to accessibility of idle-mixture-adjusting screw when installed.
  - Fasten bottom part of air filter housing with both hexagon screws (A/F 10).
  - Re-fasten hose from blow-off change-over valve on bottom part of air filter housing.
  - Assemble air filter and fasten with rubber bands.
  - Correctly connect air intake hoses.



- 1 = Hot-wire air-mass sensor
- 3 = Plug
- Press retainer in direction of arrow when disconnecting plug
- 1 = Intake hose
- 2 = Air-filter housing top part
- 3 = Air-filter housing bottom part
- 4 = Hose to blow-off change-over valve
- 5 = Hexagon screws
- 6 = Hot-wire air-mass sensor



Continued on M13/M14

**M11**

Idle speed and CO adjustment  
Porsche 928 S USA



**M12**

Idle speed and CO adjustment  
Porsche 928 S USA



Idle speed and CO concentration too low or too high (continued)

yes

Cold start control O.K.?  
(Control unit function)

- Remove pump fuse (1) and unplug 2-pin plug-in connection above central-electrics box.
  - Connect test lead between an injection valve.
  - Disconnect plug from engine temperature sensor II (double NTC). Colour of plug blue.
  - Connect motortester/multi-meter to test lead. (Setting V, measuring range 10 V).
- Start engine.  
Voltage at injection valve must drop during starting from approx. 4 V to approx. 0.5 V (with engine at normal op. temp. or with NTC II plug connected, the voltage is less than 0.5 V). After testing, re-establish the original condition.

yes

Continued on M17/M18

no

Functional test:

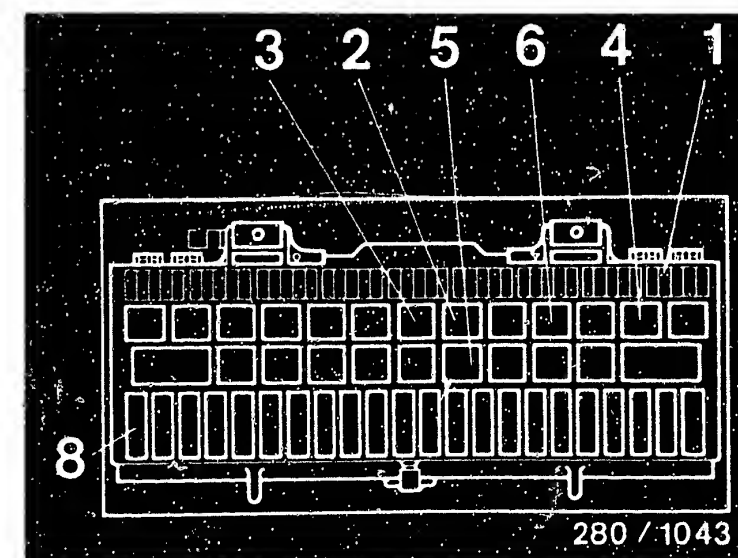
- Hinge up running plate (front passenger footwell cover plate behind the floor mat).
- Remove pump fuse (bottom picture Item 1).
- Unplug 2-pin plug-in connection above the central-electrics box. (Green and white shielded connecting leads).

Continued on M15/M16



1 = 2-pin plug connector

Central-electrics box  
1 = Pump fuse



**M13**

Idle speed and CO adjustment  
Porsche 928 S USA



**M14**

Idle speed and CO adjustment  
Porsche 928 S USA



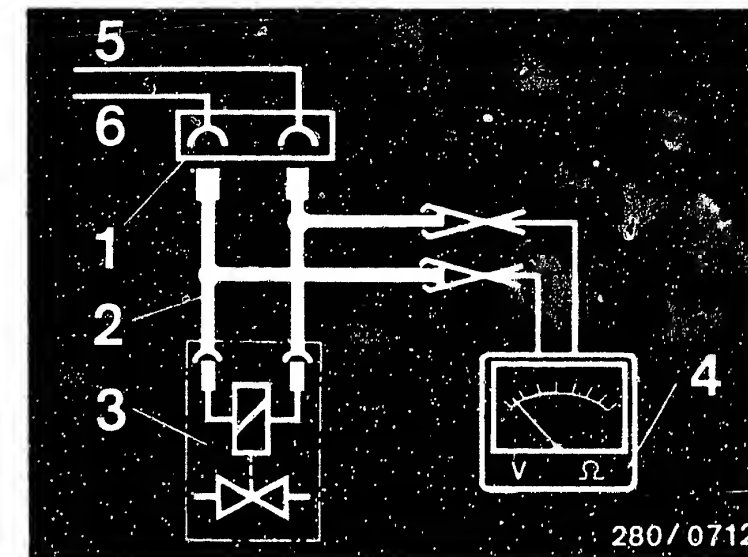
Idle speed and CO concentration too low or too high (continued)

yes

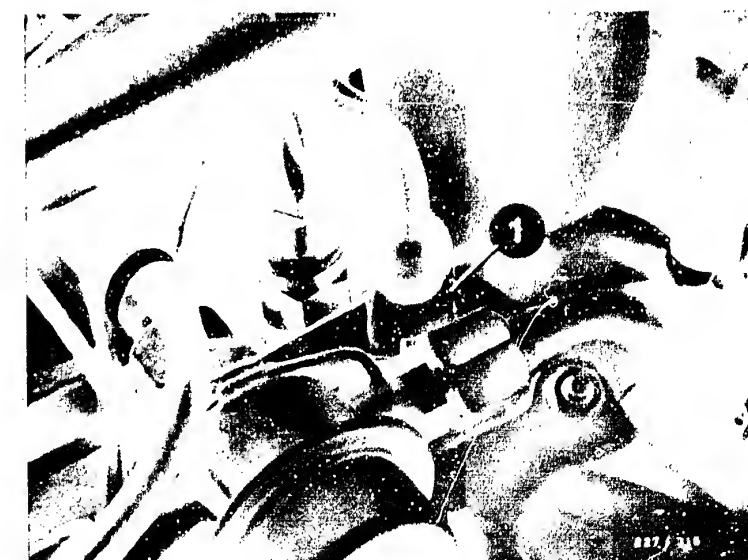
- Connect test lead 1 684 463 093.  
Connect 2-pole test lead 1 684 463 093 between an injection valve and its electrical connecting lead.
- Connect multimeter to unoccupied measuring poles. Measuring range approx. 10 V.
- Disconnect plug from temperature sensor II (engine).  
(Double NTC, colour of plug blue). Engine must not start while the starting motor is operated.
- Measuring:
  - Crank engine.
  - Voltage reading drops from initially approx. 4 V within approx. 10 s cranking time to approx. 0.5 V. If voltage readings not obtained, replace control unit.
  - Wait approx. 1 minute before repeating test.
  - Connect plug to temperature sensor. If engine at normal operating temperature, start. Voltage reading less than 0.5 V. If voltage reading not as stated, replace temperature sensor II (double NTC).

Caution:

After testing, re-establish the original condition.



- 1 = Connector of injection valve lead
  - 2 = Test lead 1 684 463 093
  - 3 = Injection valve
  - 4 = Multimeter/motortester
  - 5 = From central-electrics box plug W No. 13
  - 6 = From control unit term. 13
- 
- 1 = Temperature sensor II (engine)



Continued on M17/M18

**M15**

Idle speed and CO adjustment  
Porsche 928 S USA



**M16**

Idle speed and CO adjustment  
Porsche 928 S USA





Idle speed and CO concentration too low or too high (continued)

yes

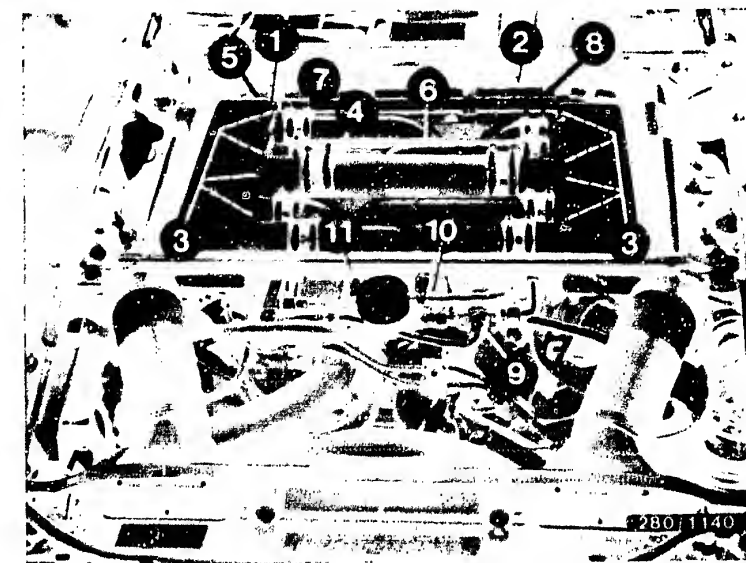
Solenoid-operated injection valves leak-tight?

no

- Leak test on injection valves
- Remove fuel-distribution pipes with injection valves (remove intake-air distributors left/right). Loosen fastening screws on fuel-distribution pipe and injection valves. Remove all 8 injection valves simultaneously and carefully from the cylinder head. Build up fuel pressure: Jump safety circuit.  
Caution: Make sure that no fuel gets onto hot parts of the engine.  
Test specification:  
Within 60 sec. no drop may fall from the mouth of the injection valve. Otherwise replace injection valve.
- Removal
  - Disconnect electrical connection.
  - Carefully remove holding clamp from groove.
  - Carefully remove injection valve from fuel-distribution pipe.  
Caution: Catch escaping fuel. Do not allow to drip onto hot parts of the engine.  
Warning: Before installing, the two O-rings must be greased only lightly (silicone grease Ft 2 v 1). The other parts of the injection valves must remain free of grease.
- Installation: Connect new injection valve carefully to fuel-distribution pipe.
  - Slide holding clamp into groove until it latches (check O-rings for leaks).  
Caution: After testing the injection valves and the fuel-distribution pipes, re-establish the original condition of installation. Check for leaks (unmetered air).

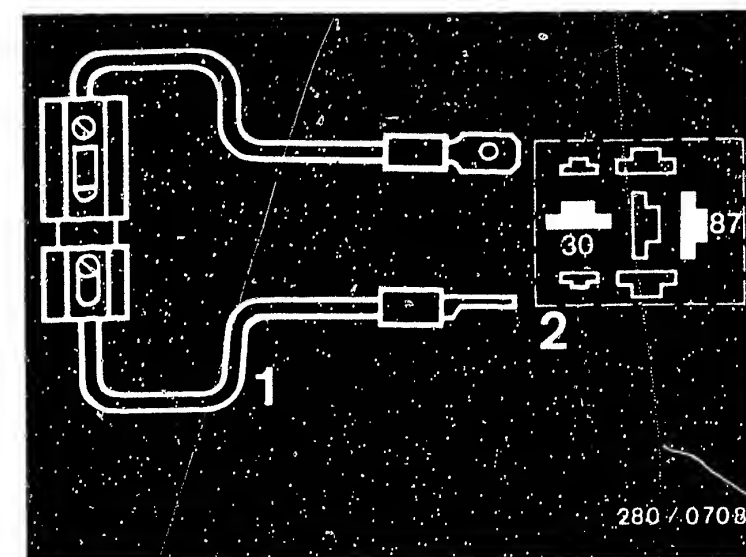
yes

Continued on M19/M20



3 = Injection valves

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)  
2 = Top view of connection base



M17

Idle speed and CO adjustment  
Porsche 928 S USA



M18

Idle speed and CO adjustment  
Porsche 928 S USA



Idle speed and CO concentration too low or too high (continued)

yes

• Leak test:

Air-intake system checked for leaks with 0.3 bar gauge pressure?

no

• Leak test:

Preparations:

- Remove left-hand and right-hand air-intake hoses.
- Loosen rubber bands on air filter and lift off top part of air filter.
- Loosen hose from blow-off change-over valve to right-hand part of lower air-filter housing half.
- Loosen 2 hexagon screws A/F 10 in bottom part of air filter housing.
- Remove bottom part of housing with hot-wire air-mass sensor.

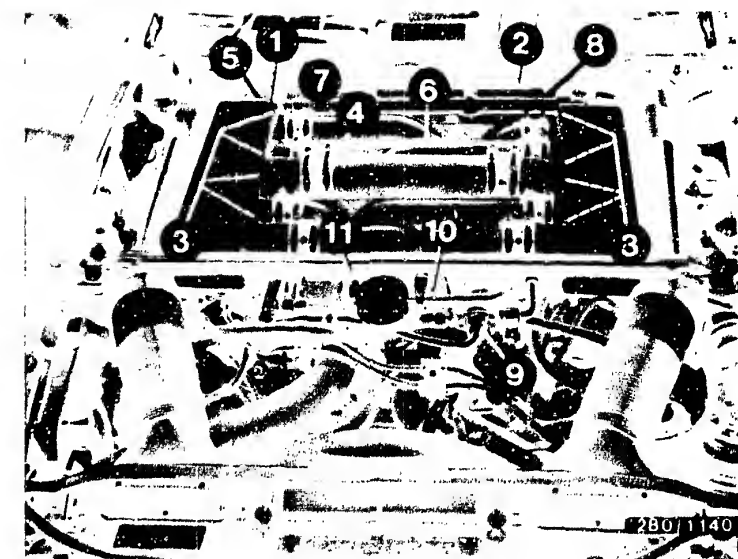
Warning: Remove air-filter housing bottom part and hot-wire air-mass sensor slowly from intake-manifold fitting. Do not lose O-ring in fitting or O-ring (dust protection on hot-wire air-mass sensor).

- Loosen hot-wire air-mass sensor from bottom part of air-filter housing (note installation position-accessibility of adjusting screw) and seal the air-inlet opening e.g. with dust-protection cover from pack).
- Re-mount bottom part of air-filter housing on hot-wire air-mass sensor.
- Disconnect both hoses from idle actuator and seal tight the hose to the inlet manifold.
- Mount bottom part of air-filter housing with the 2 hexagon screws A/F 10.

yes

Continued on M21/M22

Continued on M21/M22



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II

M19

Idle speed and CO adjustment  
Porsche 928 S USA



M20

Idle speed and CO adjustment  
Porsche 928 S USA



# Idle speed and CO concentration too low or too high (continued)

yes

Trouble-shooting program completed for customer complaint

"Idle speed and CO concentration too low or too high".

Fault eliminated?

no

## • Testing

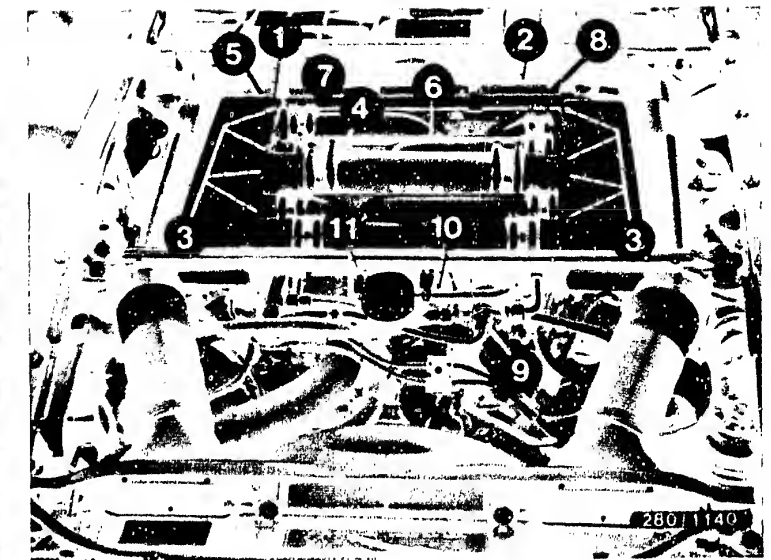
- Blow air (0.3 bar gauge pressure) into the intake manifold with compressed-air gun.
- Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine:
- Oil dipstick not securely inserted.
- Defective cap seal on oil filler neck.
- O-ring in intake-manifold fitting, intake-air distributor, connecting hoses etc. leaking.
- Bubbling or foaming indicates a leak.

## • Installation

Install in the reverse sequence to removal. Lightly grease O-ring in intake manifold fitting (acid-free grease). Remove dust-protection cover. Re-establish the original condition.

## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C8). If the fault has not been detected with the "direct trouble-shooting chart", see "detailed trouble-shooting chart" (Coordinates C3...C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



- 1 = Output stage ground terminal
- 2 = Electronics ground terminal
- 3 = Injection valves
- 4 = Idle actuator
- 5 = Pressure regulator
- 6 = Hot-wire air-mass sensor
- 7 = Air filter
- 8 = Pressure damper
- 9 = Pressure damper
- 10 = Throttle-valve switch
- 11 = Temperature sensor II



# Technical Bulletin

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28

EXCHANGEABLE NON-RETURN VALVES  
in electric fuel pumps 0 580 464 ..

VDT-I-26J/107 En

9.1984

(Supersedes Ed. 3.1983)

Electric fuel pump	Parts set (non-ret. valve and seal ring)	Non-return valve	Seal
0 580 364 002	---	1 583 386 011	1 580 203 001
0 580 464 005	---	008	001
006	---	008	001
007	---	008	001
009	---	008	001
010	---	008	001
017	1 587 010 002		
018	007		
021	006		
022	007		
024	006		
025	007		
027	006		
028	006		
029	1 587 010 506		
030	006		
031	005		
1 580 464 997	006		

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**N1**

Technical Bulletin

Porsche 928 S USA



# After-sales Service

## Technical Bulletin

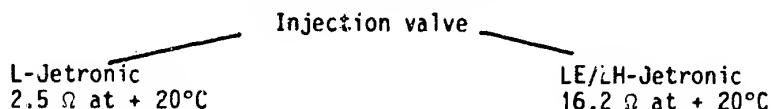
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CODING OF LE/LH-JETRONIC  
SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En

5.1982

With the introduction of the LE/LH-Jetronic the internal resistance of the solenoid-operated injection valves has also been changed.



The connector has been left the same for cost reasons and to meet customer wishes.

### Caution!

If L-Jetronic injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the injection valves will suffer irreparable damage.

### Note:

- Install only injection valves with the part number designated for the vehicle.
- As a guide, injection valves with 16.2  $\Omega$  internal resistance have a yellow protective sleeve.



- A colour coding (yellow) of the connector (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic injection valves.

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**N2**

Technical Bulletin

Porsche 928 S USA





# Technical Bulletin

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28

PLUG CONNECTORS FOR  
JETRONIC COMPONENTS  
Parts sets

VDT-I-280/111 En

11.1984

(supersedes edition 11.1982)

Parts sets are available for replacement of Jetronic plug connectors. These consist of:

- Plug connector housing
- Protective cap (rubber sleeve)
- Contact springs

These parts are listed on microfiche EE...\*.

\* see microfiche EE00 under 0 280 ..

- Plug, black, 2-pin,  
parts set 1 287 013 002 cable connector in conjunction with socket, 2-pin
- Socket, black, 2-pin,  
parts set 1 287 013 001 for e.g.

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..

- Socket, grey, 2-pin  
parts set 1 287 013 003 for:

Solenoid-operated injection valve	0 280 150 ..
--------------------------------------	--------------

**N3**

Technical Bulletin

Porsche 928 S USA



- Socket, black, 3-pin,  
parts set 1 237 000 039 for:  
Throttle-valve switch 0 280 120 ..
- Socket, black, 5-pin,  
parts set 1 287 013 006 for:  
Air-flow sensor 0 280 20. ..  
(LE version)
- Socket, black, 6-pin,  
parts set 1 287 013 004 for  
Air-flow sensor 0 280 200 ..
- Socket, black, 7-pin,  
parts set 1 287 013 005 for:  
Air-flow sensor 0 280 20. ..  
Air-mass sensor 0 280 211 ..
- Wiring-harness plug connector, black, 25-pin  
parts set 1 287 013 009 for:  
Control unit 0 280 0..
- Wiring-harness plug connector, black, 35-pin,  
parts set 1 287 013 008 for:  
Control unit 0 280 0..

The contact springs (minitimers) are also available separately under part no. 1 284 477 026.

The plug-connector housings are only available in the stated colours.

Responsible:

Robert Bosch GmbH

Division KH

Technical After-Sales Service (KH/VKD 2)

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# Technical Bulletin

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28

L-JETRONIC

VDT-I-280/112 En

System version LH 2

8.1984

After-sales service procedure

supersedes Ed. 12.1983

## Brief description of system

In contrast to the basic version of the L-Jetronic, the LH version measures the air mass instead of the air flow.

The signals are processed in the control unit using digital (and not analog) techniques. The operation of the other components is as in the L versions.

## User

Porsche is equipping its 928 S model (Europe version) with the LH 2 version as of 8.83.

## Components

Control unit 0 280 002 5..

Hot-wire air-mass sensor 0 280 214 0..

Further components as in L version vehicles.

The precise part numbers are listed on the respective vehicle microfiche AA .. .

**N5**

Technical Bulletin

Porsche 928 S USA



### Service parts/exchange parts

The control unit will be available as an exchange part one year after the vehicle start-up date (see microfiches WB.. and PD 02).

### Test concept

The system is tested in the vehicle using the universal test adapter in conjunction with a special adapter lead and a commercially available multimeter.  
Special tools are not required.

### Test equipment

Universal test adapter

ETT 018.01

Part No. 0 684 101 801

Adapter lead

Part No. 1 684 463 141

Supplied through usual channels (RG/AV).

### Test equipment hire

The adapter lead can be hired for testing:

In countries outside Germany: From your RG/AV.

### Technical documentation

Technical Bulletin "New Product" VDT-I-280/4 of 10.83 and VDT-I-280/7.

Trouble-shooting instructions and test specifications: SIS microfiche POR 504.



### System training

Integrated in the L-Jetronic course.

### Retrofitting

This system is not intended for retrofitting.

### Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period to your national representative for warranty assessment.

Published by:

Robert Bosch GmbH

Division KH

Technical After-Sales Service (KH/VKD 2)

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**N7**

Technical Bulletin

Porsche 928 S USA





# After-sales Service

## Motor Vehicle Service Information

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EXPORT VEHICLES WITH

EMISSION CONTROL SYSTEMS

VDT-I-Gen. 042 En.

12. 1981

K-Jetronic and L-Jetronic

Export vehicles for countries with stringent exhaust emission regulations are equipped with various emission control systems. To meet the legal requirements, these systems are installed either individually or in combination, depending on the model version.

Emission control system	installed predominantly in export vehicles				
	Sweden	Australia	Canada	USA	Japan
Exhaust-gas recirculation*	•	•	•	(•)	(•)
Secondary-air induction*	•	•	•	(•)	(•)
Secondary-air injection*	•	•	•	(•)	(•)
Catalytic converter*	-	-	-	•	•
Lambda closed-loop control	-	-	-	•	•

The vehicle-related After-Sales Service Instruction Manuals for the K-Jetronic and L-Jetronic describe the construction, function and operating principle of the emission control systems. The influence of these systems should be borne in mind particularly when adjusting the idle speed and CO concentration.

Export vehicles are sometimes also encountered in countries which do not have particularly stringent exhaust emission legislation. This Service Information publication summarizes the various emission control systems and provides information for the After-Sales Service in countries with exhaust emission legislation which does not require such emission control systems or unleaded fuel.

\* Not made by Bosch

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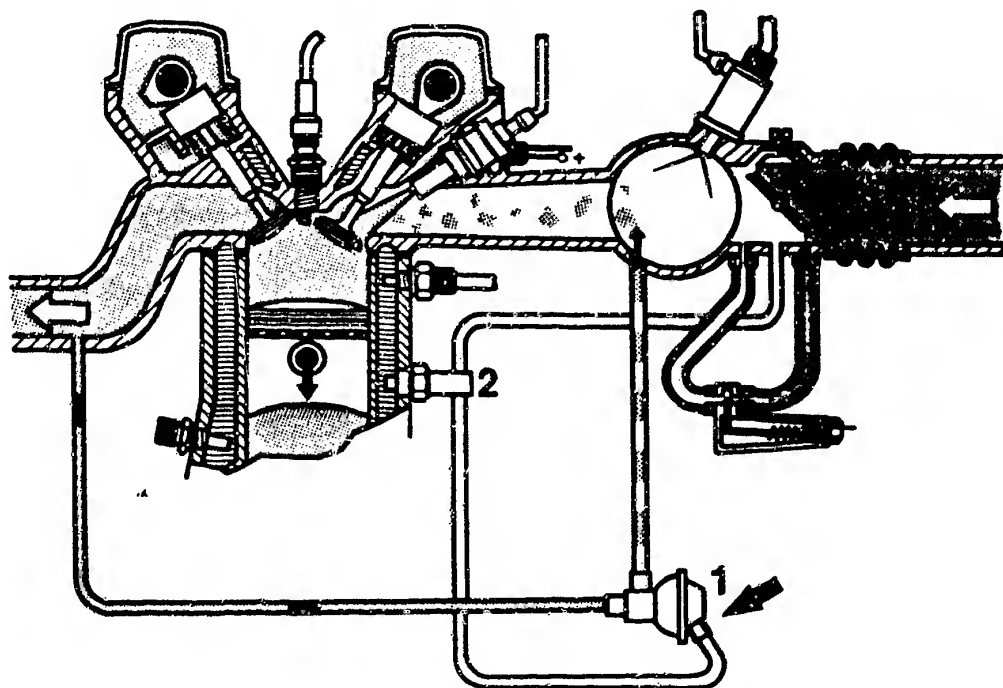
**N8**

Motor Vehicle Service Information

Porsche 928 S USA



## 1. Exhaust-gas recirculation (EGR)



1 = Exhaust-gas recirculation valve      2 = Thermo-valve

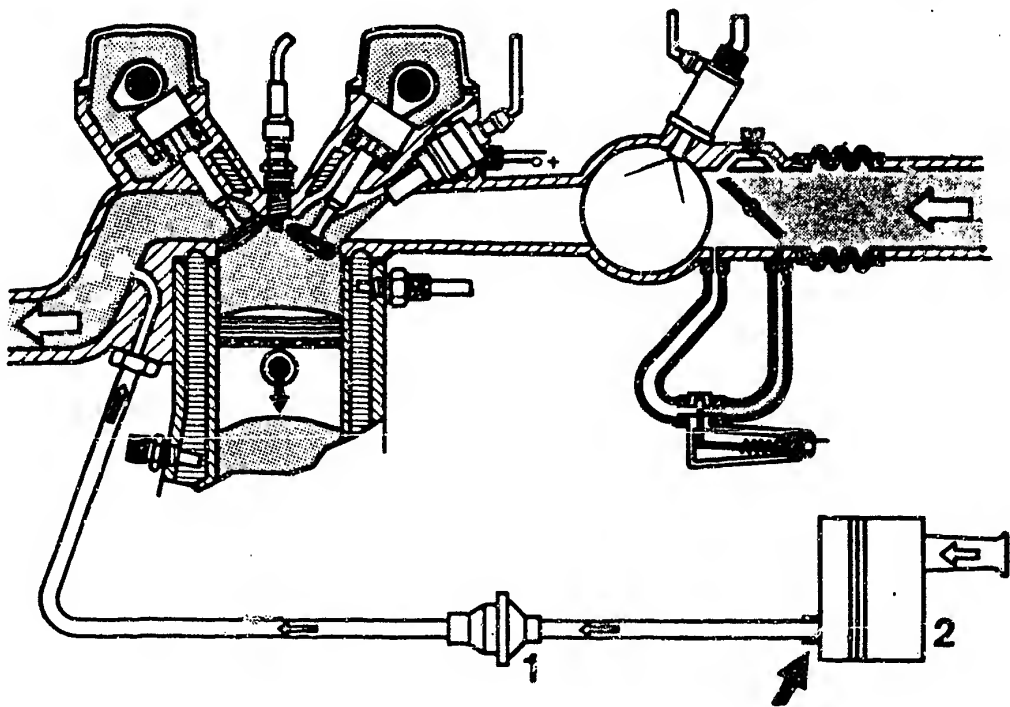
Some of the exhaust gas is returned to the intake manifold via a vacuum-controlled exhaust-gas recirculation valve. This recirculation of exhaust gas into the combustion chamber lowers the combustion temperature and reduces the emission of nitrogen oxides (NOx). The thermo-valve and the position of the vacuum tapping port on the throttle-valve assembly ensure that exhaust gas is only recirculated when the engine is warm and only at part load. There is a reduction in engine speed of about 200 min<sup>-1</sup>. Exhaust-gas recirculation is inoperative at idle, full-load and when the engine is cold.

When testing or adjusting the idle speed and CO concentration, remove and seal off the vacuum control line (arrow) on the exhaust-gas recirculation valve in order to ensure that the exhaust-gas recirculation system is inoperative.

In countries without stringent exhaust emission legislation it is not necessary to shut down the system.



## 2. Secondary-air induction (e.g. Volvo Pulsair system)



1 = Non-return valve

2 = Air filter

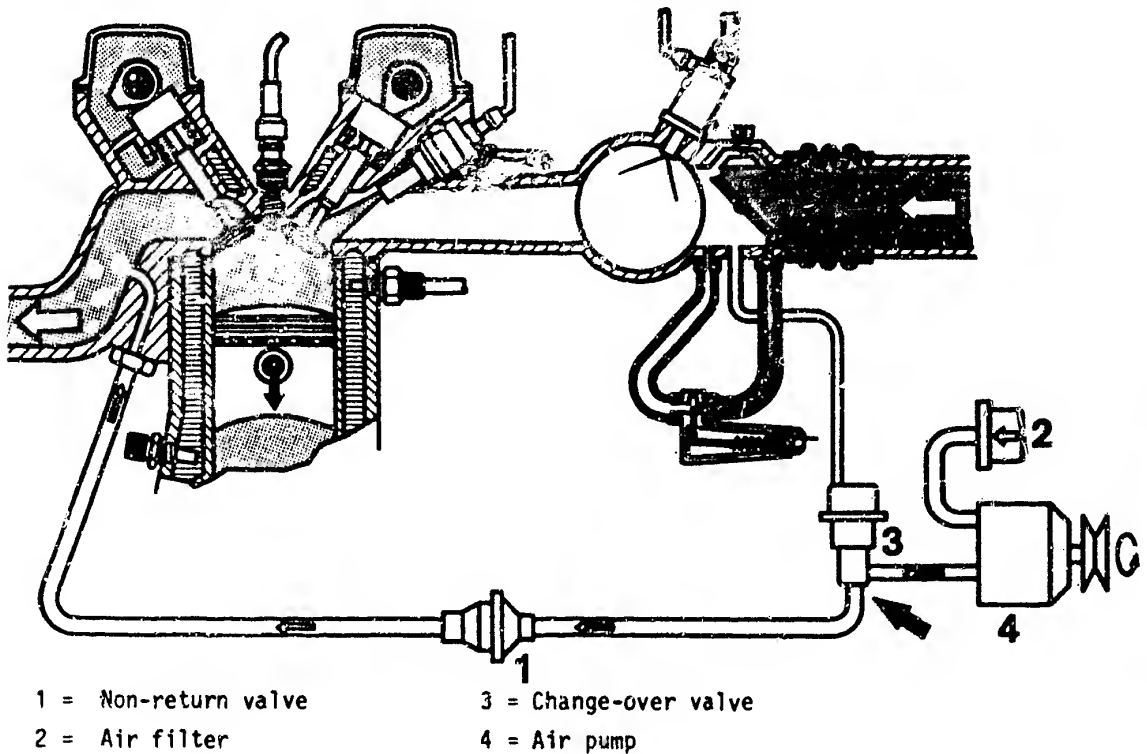
The pulsating alternation between overpressure and depression in the flow of exhaust gas inducts fresh air into the exhaust ports via a non-return valve. Unburned residues of carbon monoxide (CO) and hydrocarbons (HC) are partially after-burned, leading to fewer pollutants in the exhaust gas.

When testing or adjusting the idle speed and the CO concentration, the secondary-air induction system must be rendered inoperative. To do this, remove the hose between the non-return valve and the air filter on the air filter (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air induction system.



### 3. Secondary-air injection



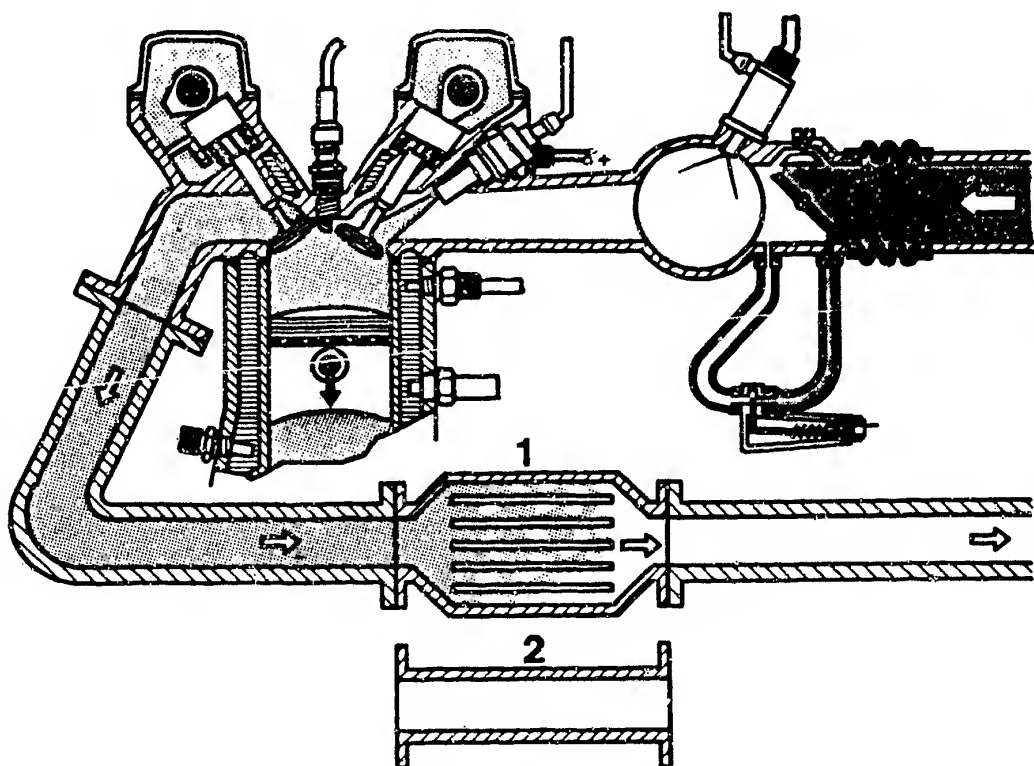
An air pump driven by the engine inducts fresh air through the air filter and forces it via a non-return valve into the exhaust ports. As in the case of secondary-air induction, there is a partial after-burning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When testing or adjusting the idle speed and the CO concentration, shut down the secondary-air injection system. To do this, remove the hose from the outlet of the change-over valve (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air injection system.



#### 4. Catalytic converter



1 = Catalytic converter

2 = Intermediate pipe

The single-bed catalyst installed in the exhaust system in export vehicles (also with lambda closed-loop control) reduces all three pollutants CO, HC and NO<sub>x</sub> to a minimum. The catalytic surface triggers chemical reactions of the pollutants, rendering them non-toxic.

Important: Proper operation only possible in conjunction with unleaded fuel (at present only in USA and Japan).

When testing or adjusting the idle speed and the CO concentration, the catalytic converter can be neglected since the exhaust-measuring point is upstream of the catalyst.

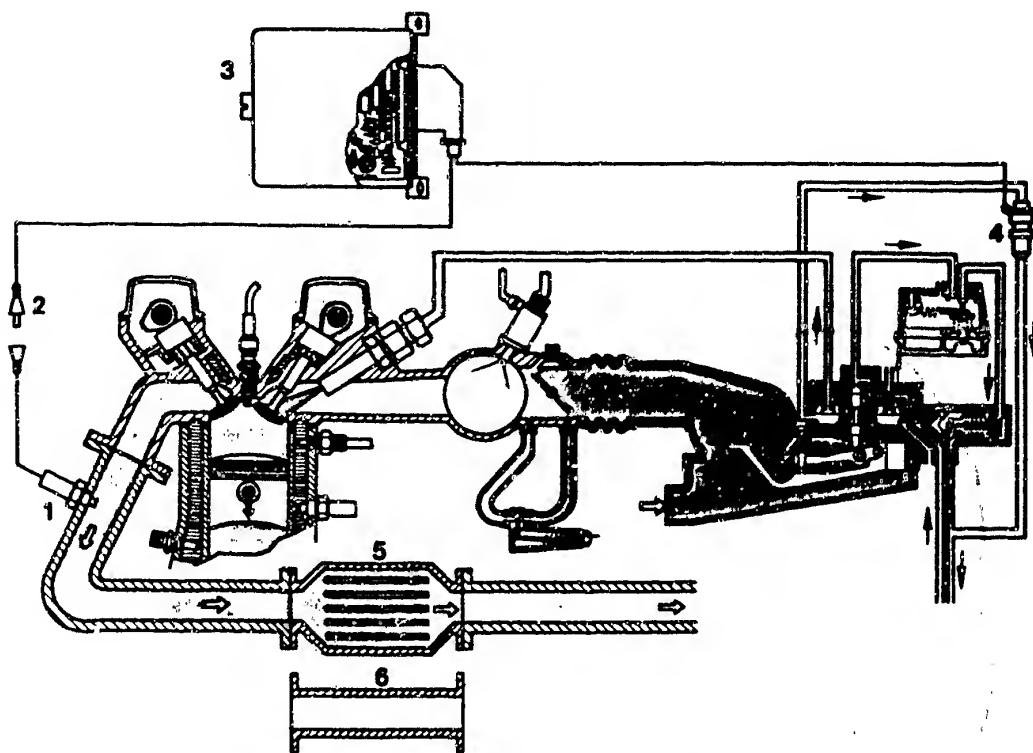
#### Caution!

If the vehicle is operated on leaded fuel (predominantly in countries without stringent exhaust emission legislation) the catalytic converter must be removed. If not removed, the catalytic converter would become clogged up and lead to a reduction in the power output of the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.



## 5. Lambda closed-loop control



1 = Lambda sensor  
2 = Plug

3 = Control unit  
4 = Timing valve

5 = Catalytic converter  
6 = Intermediate pipe

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function of the K-Jetronic or L-Jetronic is not a downstream emission control system, but ensures a low pollutant content in the exhaust gas by means of optimum mixture preparation. Additional exhaust-gas recirculation, secondary-air induction or secondary-air injection is therefore not necessary in most cases. Like the catalytic converter, the lambda sensor (in the exhaust gas) operates only with unleaded fuel.

If the vehicle is operated on leaded fuel, the lambda sensor becomes clogged up and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control. The system then operates on a fixed air-fuel ratio in the same manner as a K-Jetronic or L-Jetronic without lambda-closed-loop control. Before operating on leaded fuel, the lambda sensor should be removed and the installation hole should be closed off with a screw plug M18x1.5 (length of thread max. 8.5 mm). The disconnected plug (2) of the sensor connecting cable should be insulated and fastened to a suitable place on the vehicle body.

### Caution!

Under no circumstances must the control unit or the timing valve be shut down on the lambda closed-loop control of the K-Jetronic.

The catalytic converter should be replaced by an intermediate pipe.

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# Motor Vehicle Service Information

Only for use within the Bosch organization. No to be communicated to any third party.

COLD-START, WARM-UP AND  
ACCELERATION PROBLEMS  
in Jetronic-equipped vehicles

VDT-I-Gen. 051 En  
10.1984  
(Supersedes Ed. 10. 82)

## Customer complaint

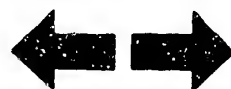
- Starting problems with cold engine
- Engine bucking during warm-up
- Rough idle (fluctuations in engine speed)
- Engine miss during acceleration (flat spot)
- Loss of power

## Cause

If the ignition and the Jetronic have been checked, and the test specifications are being reached, coking of the intake valves might be the cause of the problems sited.

Oil carbon, with its sponge effect, delays the continuous movement of the fuel from the fuel-injection valve to the combustion chamber.

As a result, the air-fuel mixture sometimes becomes so lean that it is no longer certain to ignite.



The loss in power is due to a reduction of the cylinder charge, and is the result of extremely serious coking.

Complex relationships between properties specific to the engine, the engine oil used, and fuels, as well as the driving cycles can produce such coking on the intake valves.

### Checking

If coking is suspected, we recommend checking the intake valves using an endoscope or a motoscope. Deposits on the valve head and/or shaft can be seen with these instruments and evaluated.

### Corrective measures

Take out the coked intake valves and remove the deposits mechanically.

### Additives

There are no reliable results yet available on the effectiveness of cleaning additives or fuel additives. The use of fuel additives can cause deposits in the fuel system and damage certain plastics and seals.

Please direct questions and comments concerning the contents to our authorized representative in your country.



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

### LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En  
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only" operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

### Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

**BOSCH**

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**N16**

Motor Vehicle Service Information  
Porsche 928 S USA



When direct trouble-shooting a specific LH2-Jetronic component, it is absolutely essential to look up the respective test step under the customer complaint.

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Idle actuator.....H 3 - H 4  
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Hose lines of air-intake and fuel  
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SectionCoordinatesTrouble-shooting program

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Hose lines of air-intake and fuel systems,  
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